



AGRICULTURAL RESEARCH INSTITUTE
, PUSA



New Zealand Department of Agriculture.

THE NEW ZEALAND
JOURNAL
OF
AGRICULTURE.

VOL. XX.

(JANUARY-JUNE, 1920.)

Published by direction of
The Hon. W. NOSWORTHY,
Minister of Agriculture.

Editor: R. H. HOOPER.

WELLINGTON.

BY AUTHORITY: MARCUS F. MARKS, GOVERNMENT PRINTER.

—
1920.

THE NEW ZEALAND JOURNAL OF AGRICULTURE.

VOLUME XX.
(January - June, 1920.)

GENERAL INDEX.

A.

Abscess on knee, cow with serous, 330.
Advice to farmers on lime-development, 155.
Agricultural shows, forthcoming, 35.
133, 196, 263, 333, 388.
Agriculture, Board of, 272.
Aluminium honeycombs, 118.
America and Europe, milk-products in, 97.
America, fruit trade with North, 269.
America, the fruit industry of North—
Co-operation and standardization, 24.
Points in apple-culture and orchard practice, 110.
Answers to inquiries, 59, 134, 193, 262, 330, 389.
Apiary, the (monthly notes), 54, 129, 186, 257, 322, 384.
Apples to Honolulu, export of, 64.
Apples, home storage of, 134.
Apricot-trees, controlling top-growth of, 195.
Argentina, testing for tuberculosis of cattle imported into, 388.
Arsenite-of-lime spray, 262.
Avonhead, bee-culture at, 119.

B.

Bee-culture at Avonhead, 119.
Bee-fodder, horse-beans for, 331.
Bees from fire-blight area, sale of, 392.
Bees from the bush, black, 195.
Boar, qualities of a herd, 171.
Board of Agriculture, 272.
Boils on horses' backs, 194.

Bones from Fiji, introduction of, 333.
Bot-fly, dealing with horse, 60.
Bran, flour, and pollard, maximum prices of, 334.
Branding cattle, 390.
Butter, hard, 134.

C.

Casein, 97, 108.
Calf-rearing: Feeding experiments at Ruakura and Weraroa, 289.
Candied lemon-peel, making, 196.
Carbon bisulphide for rabbit-poisoning, 62.
Cats, failure to rear, 60.
Cattle imported into Argentina, testing for tuberculosis, 388.
Certificate-of-record testing, 21, 65, 218.
Cheese-manufacture, pasteurization in, 5.
Chemical treatment of tree-stumps, 262.
Coccidiosis of poultry; Local occurrence among turkeys, 352.
Concrete water-tanks, 114.
Concrete work, sore hands after, 298.
Condensed milk, 97, 107.
Control of rabbit nuisance, 64.
Control of silver-blight: Hastings and Arataki, 374.
Control of red mite on apple-trees: Tests at Papanui Experimental Orchard, 176.
Cool-air fruit-storage, natural, 166.
Cool-storage, fruit, 10.
Co-operative fruit - variety testing: Tasman and Lower Moutere areas, 178.

Cost of feeding pullets to six months old: Trial at Milton Poultry-station, 371.

Cow with inflammation of head-passages, 262.

Cow with serous abscess on knee, 330.

Cows and soil-deficiency, 134.

Cows, testing of purebred dairy, 21, 65, 218.

Cows with foot trouble, 194.

Cracks between cows' toes, 195.

Cream and milk for factory supply, 144, 220, 302.

Cream-grading, 305.

Cream-separation, 60.

Crops, rotation of: A system for dairy farms, 94.

Cucumbers under glass, 57.

Currants, red and black, 327.

D.

Daily variations in milk-test: Some data from C.O.R. work, 346.

Dairy-farm stock, management of: Wintering stock, 1.

Dairy factories, &c., registrations of, 392.

Diatomaceous and siliceous earths, 208.

Dog with skin trouble, 391.

Dog with split pad, 135.

Dominion Farmers' Institute, 197.

Duroc pigs, 119.

E.

Earths, diatomaceous and siliceous, 208.

Economic investigation of the montane tussock-grassland of New Zealand—

V. Regeneration of grassland after depletion, 82.

VI. Further details regarding the relative palatability for sheep of various pasture-plants, 209.

VII. On the effect of understocking and stocking to its full capacity a certain area, 337.

Ensilage at Weraroa, 288.

Estimated yields of wheat and oat crops, 136.

Eradication of silver-fern, 358.

Europe and America, milk-products in, 97.

Export of apples to Honolulu, 64.

Explosives for hard-pan in orchard, 193.

F.

Farm homestead, laying out the, 245.

Farm-school at Ruakura, teachers', 109.

Farm training for demobilized British officers, 271.

Farrowing of pigs, 286.

Feed for young horse, 390.

Feeding of breeding-sows, 333.

Feeding of calves: Experiments at Ruakura and Weraroa, 289.

Feeding pullets to six months old; cost of, 371.

Fern, eradication of silver, 358.

Fern on arable land, eradicating, 331.

Fertilizers, radio-active, and plant-growth, 172.

Fertilizers, importation of, 366.

Field-day at Ashburton experimental area, 119.

Field-day at Weraroa, 117.

Fiji, introduction of bones from, 333.

Fiji, introduction of stock into, 335.

Fire-blight area, sale of bees from, 392.

Fire-blight: A serious disease of fruit-trees, 156.

Fire-blight campaign, the, 181, 252, 317.

Flood-gate, a good type of, 19.

Flour, bran, and pollard, maximum prices of, 334.

Fodder-crop note, a Southland, 377.

Foot-trouble, cows with, 194.

Forage crops for sheep, 59.

Forestry articles, 18.

Forestry practice, phases of, 36.

Forestry report, 1918-19, the State (review), 198.

Formalin treatment for seed potatoes, 332.

Fowls, crossing breeds of, 332.

Freezing works, meat, in New Zealand, 333, 336.

Fruit cool storage: Experiments with apples and pears, 10.

Fruit-export regulations, 200.

Fruit for local consumption, regulations governing sale of New-Zealand-grown, 264.

Fruit industry of North America, the—Co-operation and standardization, 24.

Points in apple-culture and orchard practice, 110.

Fruit-marketing in New Zealand, 379.

Fruit-storage, natural cool-air, 166.

Fruit trade with North America, 269.

Fruit-trees blossoming out of season, 217.

Fruit-trees, protecting, from rabbits, 195.

Fruit-trees in Central Otago, mortality among, 359.

Fruit-trees, red mite and woolly aphis on nursery: Control tests at Aratiki, 250.

Fruit-variety testing, co-operative Tasman and Lower Moutere areas, 178.

G.

Garden, the (monthly notes), 56, 132, 190, 260, 324, 358.
 Geology of limestone, the, 231.
 Gooseberries, 326.
 Grass-grub and wheat, 263.

H.

Hair, importation of animal, 388.
 Hard-pan in orchard, explosives for, 193.
 Harvesting field-peas, 332.
 Haymaking in the South, 113.
 Heifer, self-sucking, 61.
 Heifers failing to get in calf, 391.
 Hemp-grading store established at Wairoa, 173.
 Herb-culture, 345.
 Herd-testing associations: The part of the Dairy Division, 174.
 Honey, treatment of unripe, 248.
 Honeycombs, aluminium, 118.
 Honolulu, export of apples to, 64.
 Horse-beans for bee-fodder, 331.
 Horse, bot-fly, dealing with, 60.
 Horse, feed for young, 390.
 Horse-feeding, varieties of oats for, 332.
 Horse with shoulder trouble, 61.
 Horses' backs, boils on, 194.

I.

Imperial requisition of wool, 136.
 Importation of animal-hair, 388.
 Importation of fertilizers: Annual statistics and review, 366.
 Improved wheat-seed, 208.
 Inflammation of head-passages, cow with, 262.
 Inoculated soil, lucerne and, 345.
 Instruction for farmers, wool, 27.
 Instruction in pig-keeping, 20.
 Interpollination for Delicious apple-trees, 390.

J.

Journal subscription rate, the, 208.
Journal subscriptions, unidentified, 388.

L.

Lambs, segregation of ram, 135.
 Land for returned soldiers, 272, 392.
 Land in New Zealand, occupation and use of: 1917-18 and 1918-19, 207.
 Land, measurement of: Simple directions for farmers, 28.

Lands Commission, Southern Pastoral, 272.

Lantana (*Lantana Camara*), 299.
 Lawsoniana shelter-hedge, 61.
 Laying out the farm homestead: The horticultural aspect, 245.
 Leaf-hopper pest, 262.
 Lemon-peel, making candied, 196.
 Lemon-trees, fruiting of seedling, 390.
 Lime-development, advice to farmers on, 155.
 Lime-requirement of New Zealand soils and lime-development, 349.
 Lime-requirement, testing for, 351.
 Limestone and lime: Mineralogy, testing and sampling, 157.
 Limestone resources of New Zealand, the, 198.
 Limestone samples, analyses of, 48, 119, 143, 288, 351.
 Limestone, the geology of, 231.
 Loganberries, 325.
 Lower Moutere and Tasman areas: Co-operative fruit-variety testing, 178.
 Lucerne and inoculated soil, 345.
 Lucerne-crop competition, 143.
 Lucerne on river gravel and on coastal sand, 365.
 Lucerne, pasturing pigs on, 113.

M.

Mackenzie country, pasture in the, 288.
 Management of dairy-farm stock: Wintering stock, 1.
 Manawatu district, soils of the, 273.
 Mangolds, feeding to cows, 389.
 Marrows and pumpkins for storing, 330.
 Maximum prices of flour, bran, and pollard, 334.
 Meadow top-dressing test at Marton, 369.
 Measurement of land: Simple directions for farmers, 28.
 Measurement of stacks to find weight of contents, 115.
 Meat-freezing works in New Zealand, 333, 336.
 Milk and cream for factory supply, 144, 220, 302.
 Milking-shed, 145.
 Milk-powder, 97, 102.
 Milk-products in America and Europe: A recent investigation, 97.
 Milk-test, daily variations in, 346.
 Montane tussock-grassland of New Zealand, an economic investigation of the, 82, 209, 337.
 Mortality among stone-fruit trees in Central Otago, 359.
 Mutual Pearl of Rock's latest record, 218.

N.

Natural cool-air fruit-storage: Some American systems, 166.
Nursery fruit-trees, red mite and woolly aphis on, 250.

O.

Oat and wheat crops, estimated yields of, 136.
Oats and wheat, threshings of, 272.
Oats at Weraroa, Garton, 328.
Oats for horse-feeding, varieties of, 332.
Occupation and use of land in New Zealand: 1917-18 and 1918-19, 207.
Officers, farm training for demobilized British, 271.
Ophiobolus graminis Sacc., etiology of, 287.
Opossum question, the, 364.
Opossums and orchards, 333.
Orchard sanitation, 238.
Orchard, the (monthly notes), 49, 124, 181, 252, 317, 379.
Orchard tillage: Implements and their use, 311.

P.

Papanui experimental orchard, red-mite control tests at, 176.
Paspalum-paddock, renovating a, 330.
Paspalum seed, 48.
Pasteurization in cheese-manufacture, 5.
Pastoral Lands Commission, Southern, 272.
Pasture for Geraldine district, 59.
Pasture in the Mackenzie country, 288.
Pasture top-dressing test in Waipukurau County, 310.
Peas, harvesting field, 332.
Pennyroyal, control of, 251.
Perennial sow-thistle, 168.
Phases of forestry practice: Canterbury experiences, 36.
Phylloxera vastatrix: Notice to viticulturists, 335.
Pig-food, potatoes as, 263.
Pig-keeping, instruction in, 20.
Pig-raising notes, 242.
Pigs, Duroc, 119.
Pigs, farrowing of, 286.
Pigs, fattening of, 391.
Pigs on lucerne, pasturing, 113.
Pigs, sunshine for young, 165.
Pigs with protruding back-passages, 196.
Pinus insignis timber for building, 194.
Plum-trees, tests with unfruitful, 9.

Pollard, flour, and bran, maximum prices of, 334.
Potatoes as pig-food, 263.
Potatoes, formalin treatment for seed, 332.
Poultry, coccidiosis of, 352.
Poultry for breeding purposes, utility (price list), 64.
Poultry, growing silver-beet for, 60.
Poultry-keeping (monthly notes), 52, 127, 184, 255, 320, 382.
Poultry on the farm, 120.
Pullets, cost of feeding to six months old, 371.
Pumpkins and marrows for storing, 330.
Purchase and sale of wheat, 270.

Q.

Qualities of a herd boar, 171.

R.

Rabbit nuisance, control of, 64.
Rabbit-poisoning, carbon bisulphide for, 62.
Rabbits, protecting fruit-trees from, 195.
Radio-active fertilizers and plant-growth, 172.
Ram lambs, segregation of, 135.
Raspberries, 326.
Red mite and woolly aphis on nursery fruit-trees: Control tests at Arataki, 250.
Red mite on apple-trees, control of, 176.
Red spider and strawberry-beds, 389.
Registrations of factories, &c., under the Dairy Industry Act, 392.
Regulations governing sale of New-Zealand-grown fruit for local consumption 264.
Renovating a paspalum-paddock, 330.
Review of C.O.R. system in 1919, 65.
Reviews and notices—
The limestone resources of New Zealand, 198.
The State forestry report, 1918-19, 198.
Ringworm in young cattle, 193.
Rotation of crops: A system for dairy farms, 94.
Ruakura calf-rearing tests, 292.
Ruakura sale of pedigree stock, 309.

S.

Sale and purchase of wheat, 270.
Sale of pedigree stock, Ruakura, 309.
Sand-dunes, Manawatu district, 273.
Sand, lucerne on coastal, 365.

Sanitation, orchard, 238.
 Shelter-trees for Hawera district, 135.
 Shows, forthcoming agricultural, 35, 133, 196, 263, 333, 388.
 Siliceous and diatomaceous earths, 208.
 Silver-beet for poultry, growing, 60.
 Silver-blight, control of: Experiments at Hastings and Arataki, 374.
 Silver-fern, eradication of, 358.
 Soil-deficiency, cows and, 134.
 Soils, lime-requirement of New Zealand, 349.
 Soils of the Manawatu district: The sand-dunes, 273.
 Soldiers, land for returned, 272, 392.
 Sore hands after concrete-work, 298.
 Southern Pastoral Lands Commission, 272.
 Sow-thistle, perennial, 168.
 Sows, feeding of breeding, 333.
 Stacks, measurement of to find weight of contents, 115.
 State forestry report, 1918 19, the, 198.
 Stock and tutu, 50.
 Stock, introduction of into Fiji, 335.
 Stone-fruit trees in Central Otago, mortality among, 395.
 Storage, fruit cool, 10.
 Storage of apples, home, 134.
 Storing marrows and pumpkins, 330.
 Strawberries, 328.
 Strawberry-beds, red spider and, 389.
 Subscription rate, the *Journal*, 208.
 Subscriptions, unidentified *Journal*, 388.
 Sugar-supply for beekeepers, 258.
 Sugar of milk, 97, 106.
 Sunshine for young pigs, 105.

T.

Tagasaste shelter fence, 135.
 Take-all disease in wheat—
 Incidence in New Zealand, 137.
 Etiology of *Ophiobolus graminis* Sacc., 287.
 Tasman and Lower Montere areas: Co-operative fruit-variety testing, 178.
 Teachers' farm school at Ruakura, 109.
 Testing for tuberculosis of cattle imported into Argentina, 388.
 Testing of purebred dairy cows, 21, 65, 218.
 Tests with unfruitful plum-trees, 9.
 Thrashings of wheat and oats, 272.
 Tillage, orchard, 311.

Top-dressing test at Marton, meadow, 369.
 Top-dressing test in Waipukurau County, pasture, 310.
 Treatment of unripe honey: Successful experiments in vacuum boiling, 248.
 Tree-stumps, chemical treatment of, 262.
 Tuberculosis of cattle imported into Argentina, testing for, 388.
 Turkeys, coccidiosis among, 352.
 Tussock-grassland of New Zealand, an economic investigation of the montane, 82, 209, 337.
 Tutu, stock and, 59.
 Tutu on montane tussock-grassland, 340.

U.

Unripe honey, treatment of, 248.

V.

Vaginitis of cows, granular, 331.
 Variations in milk-test, daily, 346.
 Viticulture (monthly notes), 55, 131, 187, 258, 323.

W.

Waipukurau County, pasture top-dressing test in, 310.
 Warts on cows' teats, 331.
 Water-tanks, concrete, 114.
 Weeds and their identification—
 Perennial sow-thistle, 168.
Lantana Camara, 299.
 Weraroa calf-rearing tests, 296.
 Wheat and oat crops, estimated yields of, 136.
 Wheat and oats, threshings of, 272.
 Wheat crop, the ensuing year's, 271.
 Wheat, sale and purchase of, 270.
 Wheat-seed, improved, 208.
 Wheat, take-all disease in, 137, 287.
 Wheats, best stand-up, 193.
 Wintering dairy-stock, 1.
 Wool, Imperial requisition of, 136.
 Wool instruction for farmers, 27.
 Woolly aphid and red mite on nursery fruit-trees: Control tests at Arataki, 250.
 Woolly aphid control: Experiments at Arataki, 372.
 Work for the coming month, 49, 124, 181, 252, 317, 379.

ILLUSTRATIONS.

	Page
Pasteurization in cheese-manufacture: Twin pasteurizing plant in a Taranaki cheese-factory	7
A good type of flood-gate—	
Bank end of large flood-gate	19
Small flood-gate	20
Measurement of land: Simple directions for farmers—	
Metal cross-staff head	28
Cross-staff made of wood	29
Diagram of field built up as the survey proceeds	29
Example of survey of irregular field	29
Scale or measure	30
Set-square	32
Plan not giving measurements	33
Method of calculating area of previous figure	33
Overcoming obstacle in measuring	33
Finding the breadth of a river	34
Phases of forestry practice: Canterbury experiences—	
One of the Selwyn Board's gum plantations (30 years old) before thinning	43
The same plantation after thinning	43
Testing of purebred dairy cows—	
Burkeyje Sylvia Posch	69
Inka Sylvia Beets Posch	69
Sultan's Daisy	73
Campanile's Sultan	73
Dominion Empress V	75
An economic investigation of the montane tussock-grassland of New Zealand:	
Regeneration of grassland after depletion—	
Depleted hillside ground in Dunstan Gorge, outside orchard area described	85
Regenerated grassland in orchard enclosure	85
Another view of same regenerated area	85
View of interior and exterior of Earnscleugh experimental area in 1911	87
Recent view in Earnscleugh experimental area, facing south	87
In the Oamaru experimental tree-planting area	89
Boundary of Oamaru experimental tree-planting area	89
Regeneration in the experimental tree-planting area on the Sugarloaf, Lowburn Ferry	91
Bluegrass tussock growing on scabweed in Sugarloaf tree-planting area	91
Regenerated area on Cromwell Development Company's land	93
Part of same area as in previous figure, but on flattish ground fully exposed to the sun	93
The fruit industry of North America: Esopus Spitzenberg tree, fourteen years old, Flood River, Oregon	111
Measurement of stacks to find weight of contents: Oblong or square stack and round stack	116
Ryecorn for thatching at Ruakura	117
Aluminium honeycomb used at Tauranga apiary	118
New South Wales State Orchestra at Ruakura	123
Take-all disease in wheat—	
Wheat-plants affected by take-all	139
Part of left-hand stem in previous figure, magnified 10 diameters	139
Diagrams of fungus <i>Ophiobolus graminis</i>	141
Milk and cream for factory supply: Plan of run-through milking-shed, separator-room, engine-room, and yards	148
Weeds and their identification: Perennial sow-thistle (<i>Sonchus arvensis</i>)	169
Returned soldiers' quarters and some of the milking Shorthorn herd at Ruakura Farm of Instruction	180
The Dominion Farmers' Institute, Wellington	197
Fruit export regulations: A package of three trays strapped	205

An economic investigation of the montane tussock-grassland of New Zealand:	
Further details regarding the relative palatability for sheep of various pasture-plants—	
General view of Conical Hill, showing the amount of ground occupied by trees	210
A pure stand of sweet-vernal grass on the hill	210
View of small piece of lower pasture of Conical Hill, showing the close grazing of the cocksfoot between the tussocks	212
The closely grazed meadow-grass (<i>Poa pratensis</i>) on the summit of the hill	212
General view of the southern tussock-clad (<i>Festuca novae-zelandiae</i>) slope of Conical Hill	214
Ground on the hill occupied by unpalatable plants	214
Poa-tussock (<i>Poa caespitosa</i>) on Conical Hill remaining uneaten after heavy stocking	216
Blue-tussock and fescue-tussock on the hill	216
Testing of purebred dairy cows: Mutual Pearl of Rock	218
Milk and cream for factory supply—	
An improved type of milk-strainer	224
Another good type of milk-strainer	224
Circular pattern of milk-strainer, with removable disks	224
Metal plunger for stirring milk or cream	225
Horizontal type of cooler for hand separator	228
Small circular cooler for large separator	228
Harvesting Bobs wheat at Ruakura	251
Soils of the Manawatu district: The sand-dunes—	
Waikanae beach (looking south)	275
Same spot as previous figure, but looking north	275
Humus-making raupo (<i>Typha angustifolia</i>) swamp, Waikanae	277
Semi-stabilized dune, Waikanae, being fixed by lupins and wild convolvulus (<i>Calystegia soldanella</i>)	277
Semi-stabilized and stabilized dunes—the latter either pasture or dune heath	279
Dune forest, Waikanae	283
Calf-rearing: Feeding experiments at Ruakura and Weraroa—	
Ruakura groups 1 and 2	290
Ruakura groups 3 and 4	291
Weraroa groups 1 and 2	294
Weraroa groups 3 and 4	295
The test-calves at Ruakura bailed up for feeding	297
Rear view of same, showing concrete yard	297
Weeds and their identification: <i>Lantana Camara</i>	
Orchard tillage: Implements and their use—	
Single-furrow Harvey plough turning furrow from the trees	312
Front view of single furrow Harvey plough, showing side hitch	312
Front view of Planet Jr. scarifier No. 41, showing how team is attached by side hitch	313
Rear view of Planet Jr. scarifier No. 41, showing method of attaching harrow to counteract side draught	313
Planet Jr. No. 8, fitted as a nine-tooth machine, scarifying close up to six-year-old trees	315
Showing construction of Planet Jr. scarifier No. 8 fitted as a nine-tooth machine	315
A recent street-window display of New Zealand wool and woollens at the office of the High Commissioner, London	
An economic investigation of the montane tussock-grassland of New Zealand: On the effect of understocking and stocking to its full capacity a certain area—	
General view of the area on Little Mount Peel	339
Close view of vegetation on opposite sides of the fence	339
Tall tussock-grassland of Little Mount Peel at 2,320 ft. altitude	341
View of some of the lightly grazed vegetation, showing abundance of tutu	341
View on the lightly stocked area on shady side, showing a good deal of mountain flax	343
View of both areas near summit of the ridge	343
View of small piece of the heavily grazed pasture	344
Coccidiosis of poultry: Oocysts from chicken, after incubation at 75° to 80	
Lucerne growing on gravel in bed of Flaxbourne River	
A Southland fodder-crop note: Harvesting the crop at Kamahi	

The New Zealand Journal of Agriculture.

CONTENTS—JANUARY, 1920.

	PAGE
Management of Dairy-farm Stock: III. Wintering Stock. <i>A. R. Young</i>	1
Pasteurization in Cheese-manufacture. <i>C. Stevenson</i>	5
Tests with Unfruitful Plum-trees. <i>Horticulture Division</i>	9
Fruit Cool Storage: Experiments with Apples and Pears. <i>G. Esam</i> ..	10
A Good Type of Flood-gate. <i>M. Paulsen</i>	19
Testing of Purebred Dairy Cows: Certificate-of-record List for December. <i>W. M. Singleton</i>	21
The Fruit Industry of North America: Co-operation and Standardization. <i>J. A. Campbell</i>	24
Measurement of Land: Simple Directions for Farmers. <i>A. Macpherson</i>	28
Forthcoming Agricultural Shows	35
Phases of Forestry Practice: Canterbury Experiences. <i>R. G. Robinson</i>	36
Work for the Coming Month:—	
The Orchard. <i>G. Esam and Instructors</i>	49
Poultry-keeping. <i>F. C. Brown</i>	52
The Apiary. <i>G. V. Westbrooke</i>	54
Viticulture. <i>S. F. Anderson</i>	55
The Garden. <i>W. H. Taylor</i>	56
Answers to Inquiries	59
Carbon Bisulphide for Rabbit-poisoning	62
Export of Apples to Honolulu	64

And Miscellaneous Matter.

NOTICES.

SUBSCRIPTIONS.—The *Journal* is issued monthly. The subscription, which is payable in advance and includes postage, is 2s. 6d. per annum. Single copy, 6d. Extra copies for subscribers, 3d. Subscriptions should be forwarded by postal note to the Publisher, Department of Agriculture, Wellington. New subscribers are requested to furnish their full names and addresses, also their occupations.

CORRESPONDENCE.—Inquiries and other *Journal* correspondence on agricultural matters should be addressed to the Editor, Department of Agriculture, Wellington. Correspondence regarding *Journal* subscriptions and requests for publications generally to be addressed to the Publisher.

New Zealand Department of Agriculture, Industries, and Commerce.

Director-General of Agriculture : C. J. REAKES, D.V.Sc., M.R.C.V.S.

Branches and Chief Functions :

LIVE-STOCK DIVISION.—A. R. Young, M.R.C.V.S., Director.

Investigation and treatment of diseases of animals, and advice to stockowners. Inspection of live-stock, meat, and slaughter-houses, rabbits and noxious weeds, and town-supply dairies. Instruction in poultry-raising. Registration of live-stock brands.

DAIRY DIVISION.—D. Cuddle, Director.

Instruction in manufacture of butter, cheese, casein, &c. Inspection of dairy factories and factory-supply dairies. Advice regarding formation of co-operative dairy companies, and factory buildings and plant. Grading of dairy-produce for export. Supervision of herd-testing associations, and testing of pure-bred dairy cows. Registration of dairy factories, &c.

HORTICULTURE DIVISION.—T. W. Kirk, Director.

Instruction in production and preservation of fruit, and viticulture. Direction of Horticultural Stations. Inspection of orchards, vineyards, nurseries, and imported fruit and plants. Instruction in beekeeping ; inspection of apiaries ; grading of honey for export. Advice regarding shelter-tree plantations, &c. Registration of orchards, nurseries, apiaries, &c.

FIELDS INSTRUCTION BRANCH.—(Directorship temporarily vacant.)

Advice and instruction to farmers regarding field crops and pastures. Direction of Experimental Farms and areas ; co-operation with local experimental work. Field and pasture investigations.

CHEMISTRY SECTION.—B. G. Aston, F.I.C., F.N.Z. Inst., Chemist.

Analysis of soils, limestones, fertilizers, stock-foods, fodder-plants, water, &c., and related advice generally. Chemical economic investigations. Registration of fertilizers.

BIOLOGY SECTION.—A. H. Cockayne, Biologist.

Investigation and advice in agricultural botany, plant-pathology, entomology, &c. Identification of economic-plant specimens, insects, &c. Seed-testing.

HEMP-GRADING SERVICE.—W. H. Ferris, Chief Hemp-grader.

Grading of New Zealand hemp for export. Advice in hemp-milling.

GRAIN-GRADING SERVICE.—A. W. Smith, Chief Grain-grader.

Grading of grain, potatoes, &c., for export or coastal shipment.

PUBLICATIONS SECTION.—R. H. Hooper, Editor.

Issues the *New Zealand Journal of Agriculture* (monthly), bulletins, reports, and other publications of the Department.

The New Zealand Journal of Agriculture.

CONTENTS—FEBRUARY, 1920.

	PAGE
Testing of Purebred Dairy Cows: Review of the C.O.R. System in 1919. <i>W. M. Singleton</i>	65
An Economic Investigation of the Montane Tussock-grassland of New Zealand: V. Regeneration of Grassland after Depletion. <i>L. Cockayne</i> ..	82
Rotation of Crops: A System for Dairy Farms. <i>J. L. Bruce</i> ..	94
Milk-products in America and Europe: A Recent Investigation. <i>W. Dempster</i>	97
The Fruit Industry of North America: Points in Apple-culture and Orchard Practice. <i>J. A. Campbell</i>	110
Concrete Water-tanks. <i>Public Works Department</i>	114
Measurement of Stacks to find Weight of Contents. <i>A. Macpherson</i> ..	115
Aluminium Honeycombs. <i>G. V. Westbrooke</i>	118
Poultry on the Farm. <i>F. C. Brown</i>	120
 Work for the Coming Month:—	
The Orchard. <i>J. A. Campbell and Instructors</i>	124
Poultry-keeping. <i>F. C. Brown</i>	127
The Apiary. <i>G. V. Westbrooke</i>	129
Viticulture. <i>S. F. Anderson</i>	131
The Garden. <i>W. H. Taylor</i>	132
Forthcoming Agricultural Shows	133
Answers to Inquiries	134
Imperial Wool Requisition	136
Estimated Yields of Wheat and Oat Crops	136

And Miscellaneous Matter.

NOTICES.

SUBSCRIPTIONS.—The *Journal* is issued monthly. The subscription, which is payable in advance and includes postage, is 2s. 6d. per annum. Single copy, 6d. Extra copies for subscribers, 3d. Subscriptions should be forwarded by postal note to the Publisher, Department of Agriculture, Wellington. New subscribers are requested to furnish their full names and addresses, also their occupations.

CORRESPONDENCE.—Inquiries and other *Journal* correspondence on agricultural matters should be addressed to the Editor, Department of Agriculture, Wellington. Correspondence regarding *Journal* subscriptions and requests for publications generally to be addressed to the Publisher.

NEW ZEALAND DEPARTMENT OF AGRICULTURE.

Director-General of Agriculture : C. J. REAKES, D.V.Sc., M.R.C.V.S.

Branches and Chief Functions :

LIVE-STOCK DIVISION.—A. R. Young, M.R.C.V.S., Director.

Investigation and treatment of diseases of animals, and advice to stockowners. Inspection of live-stock, meat, and slaughter-houses, rabbits and noxious weeds, and town-supply dairies. Instruction in poultry-raising. Registration of live-stock brands.

DAIRY DIVISION.—D. Ouddie, Director.

Instruction in manufacture of butter, cheese, casein, &c. Inspection of dairy factories and factory-supply dairies. Advice regarding formation of co-operative dairy companies, and factory buildings and plant. Grading of dairy-produce for export. Supervision of herd-testing associations, and testing of pure-bred dairy cows. Registration of dairy factories, &c.

HORTICULTURE DIVISION.—T. W. Kirk, Director.

Instruction in production and preservation of fruit, and viticulture. Direction of Horticultural Stations. Inspection of orchards, vineyards, nurseries, and imported fruit and plants. Instruction in beekeeping; inspection of apiaries; grading of honey for export. Advice regarding shelter-free plantations, &c. Registration of orchards, nurseries, apiaries, &c.

FIELDS INSTRUCTION BRANCH.—(Directorship temporarily vacant.)

Advice and instruction to farmers regarding field crops and pastures. Direction of Experimental Farms and areas; co-operation with local experimental work. Field and pasture investigations.

CHEMISTRY SECTION.—B. G. Aston, F.I.C., F.N.Z. Inst., Chemist.

Analysis of soils, limestones, fertilizers, stock-foods, fodder-plants, water, &c., and related advice generally. Chemical economic investigations. Registration of fertilizers.

BIOLOGY SECTION.—A. N. Cockayne, Biologist.

Investigation and advice in agricultural botany, plant-pathology, entomology, &c. Identification of economic-plant specimens, insects, &c. Seed-testing.

HEMP-GRADING SERVICE.—W. H. Ferris, Chief Hemp-grader.

Grading of New Zealand hemp for export. Advice in hemp-milling.

GRAIN-GRADING SERVICE.—A. W. Smith, Chief Grain-grader.

Grading of grain, potatoes, &c., for export or coastal shipment.

PUBLICATIONS SECTION.—R. H. Hooper, Editor.

Issues the *New Zealand Journal of Agriculture* (monthly), bulletins, reports, and other publications of the Department.

The New Zealand Journal of Agriculture.

CONTENTS—MARCH, 1920.

	PAGE
Take-all Disease in Wheat: Incidence in New Zealand. <i>R. Waters</i> ..	137
Lucerne-crop Competition. <i>J. W. Deem</i>	143
Milk and Cream for Factory Supply: The Production of Sound Raw Material. <i>G. M. Valentine</i>	144
Advice to Farmers on Lime-development	155
Fire-blight: A Serious Disease of Fruit-trees. <i>A. H. Cockayne</i> ..	156
Limestone and Lime: Mineralogy, Testing, and Sampling. <i>P. G. Morgan</i>	157
Natural Cool-air Fruit-storage: Some American Systems. <i>J. A. Campbell</i>	166
Weeds and their Identification: Perennial Sow-thistle. <i>E. Atkinson</i> ..	168
Radio-active Fertilizers and Plant-growth. <i>B. C. Aston</i>	172
Herd-testing Associations: The Part of the Dairy Division. <i>W. M. Singleton</i>	174
Control of Red Mite on Apple-trees: Tests at Papanui. <i>G. Stratford</i>	176
Co-operative Fruit-variety Testing: Tasman and Lower Montere Areas. <i>W. T. Goodwin and W. C. Hyde</i>	178
Work for the Coming Month: The Orchard, <i>J. A. Campbell and</i> <i>Instructors</i> ; Poultry-keeping, <i>F. C. Brown</i> ; The Apiary, <i>G. V.</i> <i>Westbrooke</i> ; Viticulture, <i>S. F. Anderson</i> ; The Garden, <i>W. H. Taylor</i>	181
Answers to Inquiries	193
The Dominion Farmers' Institute	197
Reviews and Notices: The Limestone Resources of New Zealand. The State Forestry Report, 1918-1919	198
Fruit-export Regulations	200
Occupation and Use of Land in New Zealand	207
Improved Wheat-seed. Diatomaceous and Siliceous Earths. The Journal Subscription Rate	208
And Miscellaneous Matter.	

NOTICES.

SUBSCRIPTIONS.—The *Journal* is issued monthly. The subscription, which is payable in advance and includes postage, is 2s. 6d. per annum. Single copy, 6d. Extra copies for subscribers, 3d. Subscriptions should be forwarded by postal note to the Publisher, Department of Agriculture, Wellington. New subscribers are requested to furnish their full names and addresses, also their occupations.

NOTE.—The annual subscription will be 4s. from 1st April, 1920.

CORRESPONDENCE.—Inquiries and other *Journal* correspondence on agricultural matters should be addressed to the Editor, Department of Agriculture, Wellington. Correspondence regarding *Journal* subscriptions and requests for publications generally to be addressed to the Publisher.

Ruakura Annual Sale of Pedigree Stock.

THE First Annual Sale of Registered Pedigree Stock will be held at the
RUAKURA FARM OF INSTRUCTION, HAMILTON EAST, on

Wednesday, 14th April next, at 12 noon,

when the following will be offered:—

39 Milking Shorthorn Bulls.

5 Jersey Bulls.

29 Berkshire Pigs (14 Boars, 15 Sows).

All the stock has been bred on the Farm, and will be sold absolutely without reserve.

Attention is called to the high standard of quality of the Ruakura herds, which has been attained by the introduction of high-class sires and very rigid culling. With few exceptions, milk and butterfat records are either semi-official or, in the case of Milking Shorthorns, have been conducted under the supervision of the Waikato Dairy Shorthorn Association, and may be found in Vols. 2 and 3 of the New Zealand Milking Shorthorn Herd-book.

Catalogues may be obtained from the Director-General, Department of Agriculture, Wellington; the Manager, Ruakura Farm of Instruction, Hamilton East; or the Auctioneers,

The Farmers' Co-operative Auctioneering Company (Ltd.), Hamilton.

Weraroa Annual Sale of Pedigree Cattle.

THIS Sale will be held at the CENTRAL DEVELOPMENT FARM,
WERAROA, on

Thursday, 8th April next, at 12 noon,

when MESSRS. ABRAHAM AND WILLIAMS (LTD.) will offer the following stock:—

19 Friesian Bulls.

4 Red Poll Bulls.

4 Ayrshire Bulls.

All these animals are six-month-olds, with the exception of one Friesian, the mature bull "Longbeach Big Patch," who is being disposed of solely for blood reasons.

The young Friesians present a happy blending of the Longbeach blood with specially selected types from the best American families. The Red Polls are also from the best imported milk-record types, and show quality and constitution. The Ayrshires are offered on behalf of the Moumahaki Experimental Farm from its well-known herd.

Conveyances will meet all trains at Levin Railway-station.

Catalogues may be obtained from the Director-General, Department of Agriculture, Wellington; the Manager, Central Development Farm, Weraroa; and the Auctioneers (Levin or Wellington).

The New Zealand Journal of Agriculture.

CONTENTS—APRIL, 1920.

	PAGE
An Economic Investigation of the Montane Tussock-grassland of New Zealand: Further Details regarding the Relative Palatability for Sheep of Various Pasture-plants. <i>L. Cockayne</i>	210
Testing of Purebred Dairy Cows: Mutual Pearl of Rock's Latest Record. <i>W. M. Singleton</i>	218
Milk and Cream for Factory Supply— <i>continued.</i> <i>G. M. Valentine</i> ..	220
The Geology of Limestone. <i>P. G. Morgan</i>	231
Orchard Sanitation. <i>W. H. Rice</i>	238
Pig-raising Notes. <i>K. W. Gorringe</i>	242
Laying out the Farm Homestead: The Horticultural Aspect. <i>W. H. Taylor</i>	245
Treatment of Unripe Honey: Experiments in Vacuum Boiling. <i>G. V. Westbrooke</i>	248
Red Mite and Woolly Aphis on Nursery Fruit-trees: Control Tests at Arataki. <i>W. H. Rice</i>	250
Work for the Coming Month: The Orchard, <i>J. A. Campbell and Instructors</i> ; Poultry-keeping, <i>F. C. Brown</i> ; The Apiary, <i>G. V. Westbrooke</i> ; Viticulture, <i>S. F. Anderson</i> ; The Garden, <i>W. H. Taylor</i>	252
Answers to Inquiries	262
Regulations governing Sale of New-Zealand-grown Fruit for Local Consumption	264
Fruit Trade with North America	269
Sale and Purchase of Wheat	270
Farm Training for Demobilized British Officers	271
Board of Agriculture. Southern Pastoral Lands Commission. Land for Returned Soldiers	272

And Miscellaneous Matter.

NOTICES.

SUBSCRIPTIONS.—The *Journal* is issued monthly. The subscription, which is payable in advance and includes postage, is 4s. per annum. Single copy, 6d. Extra copies for subscribers, 4d. Subscriptions should be forwarded by postal note to the Publisher, Department of Agriculture, Wellington. New subscribers are requested to furnish their full names and addresses, also their occupations.

CORRESPONDENCE.—Inquiries and other *Journal* correspondence on agricultural matters should be addressed to the Editor, Department of Agriculture, Wellington. Correspondence regarding *Journal* subscriptions and requests for publications generally to be addressed to the Publisher.

NEW ZEALAND DEPARTMENT OF AGRICULTURE.

Director-General of Agriculture : C. J. REAKES, D.V.Sc., M.R.C.V.S.

Branches and Chief Functions :

LIVE-STOCK DIVISION.—A. R. Young, M.R.C.V.S., Director.

Investigation and treatment of diseases of animals, and advice to stockowners. Inspection of live-stock, meat, and slaughter-houses, rabbits and noxious weeds, and town-supply dairies. Instruction in poultry-raising. Registration of live-stock brands.

DAIRY DIVISION.—D. Cuddie, Director.

Instruction in manufacture of butter, cheese, casein, &c. Inspection of dairy factories and factory-supply dairies. Advice regarding formation of co-operative dairy companies, and factory buildings and plant. Grading of dairy-produce for export. Supervision of herd-testing associations, and testing of pure-bred dairy cows. Registration of dairy factories, &c.

HORTICULTURE DIVISION.—T. W. Kirk, Director.

Instruction in production and preservation of fruit, and viticulture. Direction of Horticultural Stations. Inspection of orchards, vineyards, nurseries, and imported fruit and plants. Instruction in beekeeping; inspection of apiaries; grading of honey for export. Advice regarding shelter-tree plantations, &c. Registration of orchards, nurseries, apiaries, &c.

FIELDS INSTRUCTION BRANCH.—(Directorship temporarily vacant.)

Advice and instruction to farmers regarding field crops and pastures. Direction of Experimental Farms and areas; co-operation with local experimental work. Field and pasture investigations.

CHEMISTRY SECTION.—B. C. Aston, F.I.C., F.N.Z. Inst., Chemist.

Analysis of soils, limestones, fertilizers, stock-foods, fodder-plants, water, &c., and related advice generally. Chemical economic investigations. Registration of fertilizers.

BIOLOGY SECTION.—A. H. Cockayne, Biologist.

Investigation and advice in agricultural botany, plant-pathology, entomology, &c. Identification of economic-plant specimens, insects, &c. Seed-testing.

HEMP-GRADING SERVICE.—W. H. Ferris, Chief Hemp-grader.

Grading of New Zealand hemp for export. Advice in hemp-milling.

GRAIN-GRADING SERVICE.—A. W. Smith, Chief Grain-grader.

Grading of grain, potatoes, &c., for export or coastal shipment

PUBLICATIONS SECTION.—R. H. Hooper, Editor.

Issues the *New Zealand Journal of Agriculture* (monthly), bulletins, reports, and other publications of the Department.

The New Zealand Journal of Agriculture.

CONTENTS—MAY, 1920.

	PAGE
Soils of the Manawatu District: I. The Sand-dunes—A Potential Asset.	
<i>B. C. Aston</i>	273
Take-all Disease in Wheat: Etiology of <i>Ophiobolus graminis</i> . <i>R. Waters</i>	287
Calf-rearing: Feeding Experiments at Ruakura and Weraroa. <i>J. L. Bruce</i>	289
Weeds and their Identification: <i>Lantana Camara</i> . <i>E. H. Atkinson</i> ..	299
Milk and Cream for Factory Supply— <i>continued</i> . <i>G. M. Valentine</i> ..	302
Pasture Top-dressing Test in Waipukurau County. <i>J. W. Deem</i> ..	310
Orchard Tillage: Implements and their Use. <i>T. E. Rodda</i> ..	311
Work for the Coming Month:—	
The Orchard. <i>J. A. Campbell and Instructors</i>	317
Poultry-keeping. <i>F. C. Brown</i>	320
The Apiary. <i>G. V. Westbrooke</i>	322
Viticulture. <i>S. F. Anderson</i>	323
The Garden. <i>W. H. Taylor</i>	324
Wool and Woollens Display at High Commissioner's Office, London ..	329
Answers to Inquiries	330
Maximum Prices of Flour, Bran, and Pollard	334
Phylloxera <i>vastatrix</i> : Notice to Viticulturists	335
Freezing-works in New Zealand	336

And Miscellaneous Matter.

NOTICES.

SUBSCRIPTIONS.—The *Journal* is issued monthly. The subscription, which is payable in advance and includes postage, is 4s. per annum. Single copy, 6d. Extra copies for subscribers, 4d. Subscriptions should be forwarded by postal note to the Publisher, Department of Agriculture, Wellington. New subscribers are requested to furnish their full names and addresses, also their occupations.

CORRESPONDENCE.—Inquiries and other *Journal* correspondence on agricultural matters should be addressed to the Editor, Department of Agriculture, Wellington. Correspondence regarding *Journal* subscriptions and requests for publications generally to be addressed to the Publisher.

THE DEPARTMENT'S EXPERIMENTAL STATIONS AND AREAS.

Ruahura Farm of Instruction, Hamilton East; railway-stations, Frankton Junction, Hamilton, or Claudelands. Dairying, stock-grazing, and general farming. Orchard; poultry section; apiary.

Central Development Farm, Weraoia; railway-station, Levin. Dairying, stock-grazing, and general farming.

Moumahaki Experimental Farm, Moumahaki; railway-stations, Moumahaki or Waverley. Dairying, stock-grazing, and general farming.

Te Kauwhata Horticultural Station, adjoining Te Kauwhata Railway-station, Lower Waikato. Fruit and vine growing; wine-making; fruit-farm settlement; black-wattle plantations, bark-mill, &c.

Arataki Horticultural Station, Havelock North; railway-station, Hastings. Fruit and vine growing, &c.

Tauranga Horticultural Station, Tauranga. Fruitgrowing (including citrus fruits). Queen-rearing apiary.

Ashburton Experimental Farm, Ashburton. General cropping—cereals, roots, fodders, &c.

The establishments are open to visitors on any day except Sundays, Good Friday, Christmas Day, and New Year's Day.

Lesser experimental areas which may be visited include the following: *Gore*, general cropping; *Winton*, general cropping; *Marion*, general cropping; *Albany* (gum lands, near Auckland), grasses, fodder plants, fruit-trees, &c.; *Puweri* (gum lands, near Whangarei), grasses, fodder plants, pasture, &c.

APIARY REGISTRATION.

BEEKEEPERS are reminded that under regulations of 1917 all apiaries of one or more colonies require to be registered during the month of June of this year. Registration-cards are being posted to all beekeepers already registered, but it is incumbent upon all owners of bees who have not hitherto registered to make application for registration-cards, which will be available from the principal offices of the Department of Agriculture in their respective districts. Registration is free of charge. The penalty for non-registration is a fine of £5.

Bound Volumes of the Journal of Agriculture.

THE Department has for sale bound half-yearly volumes of the *Journal*—from Vol. IV to Vol. XIX (1912-19) inclusive.

The volumes are well bound in green cloth boards. All have a general index.

Price: 4s. 6d. per volume; or 5s., postage paid to any address. (Remittance with order.)

APPLY TO

THE PUBLISHER, DEPARTMENT OF AGRICULTURE,
WELLINGTON, N.Z.

The New Zealand Journal of Agriculture.

CONTENTS—JUNE, 1920.

	PAGE
An Economic Investigation of the Montane Tussock-grassland of New Zealand: VII. On the Effect of Understocking and Stocking to its full Capacity a certain Area. <i>L. Cockayne</i>	338
Daily Variations in Milk-test. <i>W. M. Singleton</i>	346
Lime-requirement of New Zealand Soils and Lime-development. <i>B. C. Aston</i>	349
Coccidiosis of Poultry. <i>H. A. Reid</i>	352
Eradication of Silver-fern. <i>J. W. Deem</i>	358
Mortality among Stone-fruit Trees in Central Otago. <i>G. H. Cunningham</i>	359
Lucerne on River Gravel and on Coastal Sand. <i>F. E. Ward</i> ..	365
Importation of Fertilizers: Annual Statistics and Review. <i>B. C. Aston</i>	366
Meadow Top-dressing Test at Marton. <i>C. H. Schwass</i>	369
Cost of Feeding Pullets to Six Months old: Trial at Milton. <i>F. C. Brown</i>	371
Woolly-aphis Control: Experiments at Arataki. <i>T. E. Rodda</i> ..	372
Experiments in Control of Silver-blight. <i>W. H. Rice and T. E. Rodda</i>	374
A Southland Fodder-crop Note	377
Work for the Coming Month: The Orchard, <i>J. A. Campbell and</i> <i>Instructors</i> ; Poultry-keeping, <i>F. C. Brown</i> ; The Apiary, <i>G. V.</i> <i>Westbrooke</i> ; The Garden, <i>W. H. Taylor</i>	379
Testing for Tuberculosis of Cattle imported into Argentina	388
Answers to Inquiries	389
Sale of Bees from Fire-blight Area. Land for Returned Soldiers.	
Registrations of Factories, &c., under Dairy Industry Act ..	392
And Miscellaneous Matter.	

NOTICES.

SUBSCRIPTIONS.—The *Journal* is issued monthly. The subscription, which is payable in advance and includes postage, is 4s. per annum. Single copy, 6d. Extra copies for subscribers, 4d. Subscriptions should be forwarded by postal note to the Publisher, Department of Agriculture, Wellington. New subscribers are requested to furnish their full names and addresses, also their occupations.

CORRESPONDENCE.—Inquiries and other *Journal* correspondence on agricultural matters should be addressed to the Editor, Department of Agriculture, Wellington. Correspondence regarding *Journal* subscriptions and requests for publications generally to be addressed to the Publisher.

THE DEPARTMENT'S EXPERIMENTAL STATIONS AND AREAS.

Ruahura Farm of Instruction, Hamilton East; railway-stations, Frankton Junction, Hamilton, or Claudelands. Dairying, stock-grazing, and general farming. Orchard; poultry section; apiary.

Central Development Farm, Weraroa; railway-station, Levin. Dairying, stock-grazing, and general farming.

Moumahaki Experimental Farm, Moumahaki; railway-stations, Moumahaki or Waverley. Dairying, stock-grazing, and general farming.

Te Kauwhata Horticultural Station, adjoining Te Kauwhata Railway-station, Lower Waikato. Fruit and vine growing; wine-making; fruit-farm settlement; black-wattle plantations, bark-mill, &c.

Arataki Horticultural Station, Havelock North; railway-station, Hastings. Fruit and vine growing, &c.

Tauranga Horticultural Station, Tauranga. Fruitgrowing (including citrus fruits). Queen-rearing apiary.

Ashburton Experimental Farm, Ashburton. General cropping—cereals, roots, fodders, &c.

The establishments are open to visitors on any day except Sundays, Good Friday, Christmas Day, and New Year's Day.

Lesser experimental areas which may be visited include the following: *Gore*, general cropping; *Winton*, general cropping; *Marlon*, general cropping; *Albany* (gum lands, near Auckland), grasses, fodder plants, fruit-trees, &c.; *Puwerā* (gum lands, near Whangarei), grasses, fodder plants, pasture, &c.

APIARY REGISTRATION.

BEEKEEPERS are reminded that under regulations of 1917 all apiaries of one or more colonies require to be registered during the month of June of this year. Registration-cards are being posted to all beekeepers already registered, but it is incumbent upon all owners of bees who have not hitherto registered to make application for registration-cards, which will be available from the principal offices of the Department of Agriculture in their respective districts. Registration is free of charge. The penalty for non-registration is a fine of £5.

Bound Volumes of the Journal of Agriculture.

THE Department has for sale bound half-yearly volumes of the *Journal*—from Vol. IV to Vol. XIX (1912-19) inclusive.

The volumes are well bound in green cloth boards. All have a general index.

Price: 4s. 6d. per volume; or 5s., postage paid to any address. (Remittance with order.)

APPLY TO

THE PUBLISHER, DEPARTMENT OF AGRICULTURE,
WELLINGTON, N.Z.



The New Zealand Journal of Agriculture.

VOL. XX.—NO. 1.

WELLINGTON 20TH JANUARY, 1920.

MANAGEMENT OF DAIRY-FARM STOCK.

III. WINTERING STOCK.

A. R. YOUNG, M.R.C.V.S., Director of the Live-stock Division.

GOOD judgment in deciding the correct time to commence winter feeding, and the adoption of proper methods in supplying that feed, is not so much in evidence throughout the country as might by now be expected. Instances are still to be observed where sufficient feed has not been provided to meet the requirements of an ordinary winter, and even where this has been done wasteful methods of feeding the supply contribute largely to a shortage before the spring feed appears, a serious loss being thereby sustained. There is a common saying, "If you want to get a farmer to think touch him in the pocket." This may be so, but it is a much more difficult task to make him understand when his pocket is really being touched. A man's pocket may be touched by taking something from it which has been there, but it is more often touched by the fact that there is something not there that should have been there in the first place. By advanced methods various business concerns are now realizing large profits from materials which at one time were going to waste. Of this there are numerous examples. Material for which there was no market when it was in one state has been turned into another for which there is a

demand. "No waste" is the business keynote of all successful undertakings—no waste in time, material, or labour, but a precise knowledge of the value of all three in their relation to each other for the production of satisfactory results. The consideration for the farmer is not only to know how much has been "touched" out of his pocket, but also how much could have been there for the same expenditure.

The first economic mistake made by a large number of farmers in wintering stock is not culling out before the winter sets in and deciding to slaughter or sell off all animals that have outlived their usefulness or are otherwise indicating that another winter's feeding is not going to increase their value or the owner's profit. Before the commencement of every winter is an opportune time to reduce the heads to be fed, leaving those that are not only likely to come through, but to show a profit by doing so. All unprofitable cows, spare horses, &c., should be got rid of. This will leave more feed for the remaining animals, and even where there is to be plenty of feed more profitable animals could be secured. This line of action would be an improvement upon that usually followed by many farmers, who only recognize that the time to get rid of such animals is when they have no more feed to give them, while for the past few months they have been consuming food that should have been given to the other stock which were working for the farmer's benefit.

Another great mistake is often made in delaying the commencement of winter feeding until the stock show appreciable signs of going back. Stock should never be allowed to go back if it can be at all avoided. Animals may fall away so much in a few days or a week that it will take three times as much food to bring them back as it would to have kept them going, it being an accepted fact that animals in good condition consume proportionately less feed than when in poor condition. Not only this, but animals in very fair condition are better able to penetrate into difficult positions to secure food and to climb rough country in search of it. How often have we seen weak cows bogged where a vigorous one could have got out, or weak animals looking for feed in bare gullies while more vigorous stock were scrambling over rough country in search of food and getting it.

There is only one way of giving stock a fair start into winter, and that is to start them strong. Very often the delay in starting winter feeding arises from doubts in the farmer's mind as to whether he will have sufficient feed to carry him through the winter or not. "Better to have some over than go short towards spring" is his motto—and not a bad one providing that it has not been at the expense of his stock that he has some over. A little feed to spare after a steady ration has been supplied to the animals all through the winter is an indication of good management, but to allow the condition of the animals to go down in early winter and have feed to spare when spring comes is surely bad judgment.

Another common cause of heavy loss in some seasons lies in the uncertainty as to the length or severity of the winter. In a given season a farmer provides what he considers reasonable winter feed, and finds that he has provided too much; next year he provides less, and may be lucky; but sooner or later misfortune befalls him because of his not adopting the simple practice of having a few weeks' or months'

feed (such as hay, ensilage, or straw) always on hand as a reserve, which would keep if not required.

The unbusinesslike manner in which a very large number of young stock are treated during winter also represents yearly a heavy loss. Take young calves, for instance: In most cases they receive fair treatment until they are weaned, and if it is the intention to sell them they are kept with a presentable appearance until then. They then change hands, when, instead of being kept going in growth and condition, they are very often turned out upon a ferny or scrubby piece of land to shift for themselves; in fact, they are laid aside, so to speak, until required. The results are often disastrous: some die early, others survive the winter and emerge into spring emaciated, scouring, and weary of life, their vitality lowered to such an extent as to render them an easy prey to most diseases. Their heads have grown, their bellies are distended, and their sex unchanged, and that is their only recommendation. Then from such a lot the farmer starts afresh to build up what never should have been lost. It is a safe estimate that, taking the general run of such animals, six months' time will be lost in bringing them to maturity, besides which there are the reductions in numbers through deaths, and a legacy of increased susceptibility to disease. Much the same treatment is often adopted with in-calf heifers, but here the neglect to supply them with sufficient nourishment is much more serious than in dealing with calves. Here is a young undeveloped animal, having still to add to her own constitution a large amount of bone and muscle, being called upon to do the double duty of providing not only for her own requirements but also for her young, often under circumstances where she has been given little to do this with, the result being that both the heifer and her young suffer.

That there is a great opening for the more scientific study of wintering stock is undoubted. To have animals in good condition and then allow them to fall away without any corresponding gain, or to have to keep animals six months longer until they are profitable, surely means waste. The first cost of working on good lines might be more, but the results would very much more than cover any additional expenditure and leave a balance to the good.

Another saving might very well be effected by the more careful handling of winter feed. It is no uncommon sight to see cattle having free access to hay or straw stacks, no provision being made to limit the supply to actual requirements, the result being that the animals will naturally destroy a large amount by tramping it underfoot. This is more especially seen with straw stacks, where the stock in their desire to obtain fine pickings of grass, &c., will pull out straw and leave it if it does not contain the titbit they are after. Yet this straw would have been eaten by them readily enough in time had it been given to them as required, and its value as a factor in balancing the ration would have been of much profit instead of waste.

Then, again, we see upon far too many farms cattle being allowed to wander all over turnip-fields from the very first day they are put in, instead of being given fresh sections as the others are used up. Allowing cattle the run of the whole field to start with is a wasteful method, as the removal of the tops and the damage done to the body of the turnip without finishing off effectually stop any further growth

that might otherwise be made in the early part of winter. Not only this, but a half-eaten turnip or mangold commences to deteriorate at once in feeding-value. Cattle should only have suitable sections of a turnip-field at a time, with a large run-off provided to encourage them to go there and bed down, thus keeping their principal feeding-ground clean. This method also allows of the portion still fenced off attaining the greatest possible weight of feed. By following this plan, also giving the hay or straw only in such quantities as will be consumed every day, it will be found that the profit taken out of the same field has been considerably increased.

SHELTER.

The planting of shelter in suitable parts of the farm for the purpose of protecting stock from cold, biting winds has not received the attention it merits, even from many practical men. One great hindrance to this good work has been the short time some farms have been occupied by the same owner, and the common aversion of doing anything for the next man's benefit. Even in this, however, a speculative error has been committed, as a farm with plenty of trees and shelter coming on to be of use is more valuable to sell than another farm of the same quality without. The present holders of land therefore cannot do better than to set about planting all spare corners, gullies, river-banks, and other such suitable places. If they sell it will pay; if they do not sell it will pay handsomely, because trees can be planted to provide shelter, posts for fencing, and firewood, which would in a very few years recompense many times over for all the trouble and outlay, while the more valuable but slower-growing timber would make sufficient growth to take their place. There is an old saying that it is not what a man earns but what he spends that counts, and this just about hits the mark here. It is not the amount of good food you give to an animal to produce heat, but the measures taken to prevent undue waste of heat that counts profit.

If there is one subject more than another that leading agricultural papers in the Dominion have drawn special attention to time after time it is that of sufficient shelter for stock. It is recognized that the annual loss to the country sustained by the want of shelter alone runs into hundreds of thousands of pounds. The question for every stockowner to ask himself is, "Am I suffering loss from this cause?" and, if so, to set to work upon the remedy. I would appeal to all farmers for a more humane consideration of the welfare of stock, because, even to this day, farms can be seen upon every hand where the only shelter provided is a barbed-wire fence. As already emphasized, the provision of proper shelter will not only contribute to the comfort of the stock and pleasure of the stockowner, but it will pay well.

Stratford Model Dairy Farm.—The sowing of swedes was completed in December, and all root crops are doing well; thirty-two varieties of swedes, fourteen varieties of turnips, and eleven varieties of cabbages are being tested, also several millets, kales, &c.

PASTEURIZATION IN CHEESE-MANUFACTURE.

C. STEVENSON, Dairy Instructor, New Plymouth.

THE chief difficulty hitherto experienced in connection with the pasteurization of milk for cheesemaking, that of heating large quantities of milk in a somewhat limited time, may be entirely overcome by the adoption of the regenerative heaters now procurable. These machines, while heating to 165° F., have a capacity of up to 1,800 gallons per hour, consequently by running a machine for two hours and a half—the time available in most factories—4,500 gallons of milk can be treated. By installing a duplicate plant 9,000 gallons can be heated in the same time, a capacity sufficient for the largest cheese-factories in the Dominion. In addition, these machines are extremely economical to run, as while working at full capacity a regeneration of 40° to 45° is obtained, thus effecting a very considerable saving in the cost of heating.

A complete plant consists of a milk-receiving vat, a regenerator, two pumps, and a large cooler, the floor-space necessary for installation being 12 ft. to 14 ft. in width by about 20 ft. in length. Some variation in placing the plant can be made in order to utilize the space which may be available in factories not specially designed for the installation of a pasteurizing plant. A milk-receiving vat with a holding-capacity of 500 to 600 gallons is sufficiently large, and where floor-space is available it is advisable to make such vats not more than 2 ft. 6 in. in depth in order to facilitate cleaning.

Two types of regenerator are at present in use, one of which discharges the milk at the top, and the other at the bottom. In both cases it is necessary to pump the milk from the receiving-vat into the regenerator, but with the former machine the milk is discharged directly to the cooler, after leaving which it is pumped to the cheese-vats. With the latter machine, discharging at the bottom, it is necessary to pump the milk from the regenerator to the cooler, which is set sufficiently high to allow the milk to gravitate to the cheese-vats. Each machine is fitted with a steam-inlet sufficiently large to utilize exhaust steam where available.

The coolers provided in most cases are of the horizontal tubular type, 12 ft. long by 4 ft. high, fitted with two water-inlets and a corresponding number of discharges, and these have been found very suitable for the work. Where high-pressure water is not available the tank supplying water to the cooler should be placed about 5 ft. higher than the top of the cooler in order to ensure a constant supply of fresh water. Where insufficient fall is provided the water passing slowly through the cooler becomes heated and considerably retards the cooling of the milk.

Only the best drawn brass piping should be used in connection with the milk-pumps, and this should be fitted in short lengths and jointed with brass unions so that it may be easily dismantled for cleaning.

In keeping with all other commodities, there has recently been an increase in the price of these heaters, the cost of installing a plant capable of dealing with 1,800 gallons of milk per hour being at the present time from £380 to £400.

Although it is evident that in heating milk to 160°-165° as against a temperature of 86° to 90° required under the unpasteurized system of cheese-manufacture there must necessarily be an increase in the amount of fuel used, a comparison of the two methods of heating will readily show that this increase is not nearly so great as would at first appear to be the case, the system of heating milk in a jacketed vat being a very extravagant one; whereas that of heating by means of the regenerator is most economical, the machines being so constructed that they utilize to the fullest possible extent every unit of heat applied.

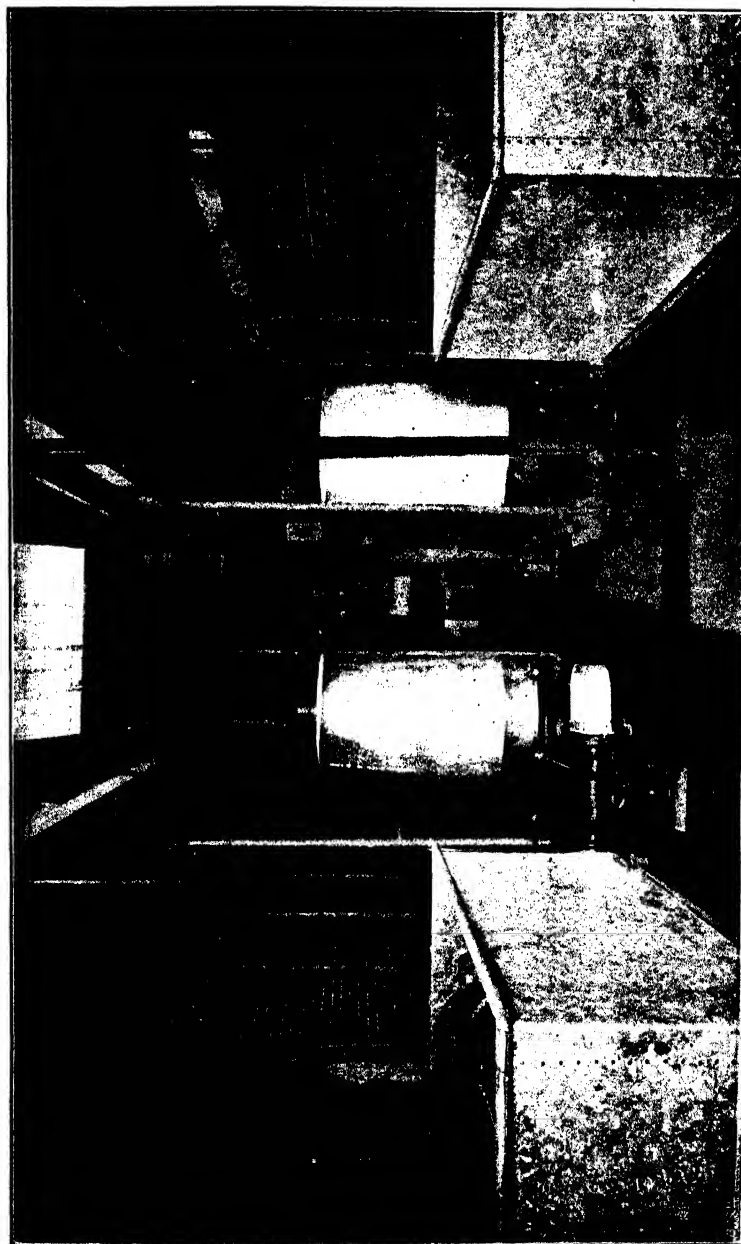
It is difficult to obtain exact figures relating to the increase in fuel-consumption, but observations made during the last three years indicate that where live steam is used the increase is from 10 to 15 per cent.; where exhaust steam is fitted to the regenerator there is practically no increase in the amount of fuel used.

The supply of water for cooling purposes should not present any difficulty. As the milk is delivered to the cooler at a temperature of 115° to 120°, and requires only to be further cooled to setting-temperature—86° to 90°—no very great quantity of water is required for this purpose. By installing a small pump the waste water from the cooler, which is perfectly clean though slightly warm, can be pumped to an elevated tank and used again for ordinary factory purposes.

The improvement in the quality of the cheese made from pasteurized milk as compared with that made under the old system has been very marked indeed. Numerous instances could be given where the average grading of a factory's output has risen from two to three points after the installation of the pasteurizing plant, and in most factories where pasteurization is carried on second-grade cheese has been almost entirely eliminated. The improvement in keeping-quality has been particularly in evidence during the past three seasons when it became necessary, owing to lack of shipping-facilities, to hold the cheese in cool store for long periods. Cheese made from properly pasteurized milk maintained its quality very much better under storage conditions than that made from milk which had not been pasteurized. Further, with pasteurization the milk dealt with for manufacturing is in practically the same condition from day to day, and consequently a very much greater degree of uniformity in the quality of the cheese can be obtained.

Although the improvement in the quality of the cheese is perhaps the chief benefit to be derived from pasteurization, there are several other advantages which clearly prove that the installation of a pasteurizing plant in cheese-factories is a paying proposition. Cheese-makers are well aware of the heavy losses hitherto sustained through working with milk which is delivered in a slightly overripe condition, a quantity of this class of milk being received at all cheese-factories during the summer months. As pasteurization will entirely overcome this difficulty the saving effected in this direction alone is very considerable.

At different stages in the process of cheese-manufacture losses of fat are observed, but these losses are considerably decreased when the



TWIN PASTEURIZING PLANT IN A TARANAKI CHEESE-FACTORY.
Showing whole apparatus—receiving-vats, milk-pumps, regenerative heaters, and coolers.

milk is pasteurized. A number of tests have been made which show that the loss of fat in the whey is on an average 0.05 per cent. less with pasteurized than with unpasteurized milk. With pasteurization there is practically no loss of fat in the cheese-presses. The elimination of the various losses indicated proves, of course, that a greater yield of cheese per pound of butterfat can be obtained under the pasteurizing system of manufacture.

The improvement in quality, and consequent reduction in the amount of second-grade cheese manufactured, means a direct monetary gain to the dairy-farmer, as the value of second-grade cheese is in all cases $\frac{1}{4}$ d. per pound less than that of first-grade. During the past season 44,240 crates of second-grade cheese were shipped from various ports throughout the Dominion. Averaging the weight of each crate at 160 lb., this quantity of cheese at $\frac{1}{4}$ d. per pound represents a direct loss to the cheese-producers of £7,373, a sum almost sufficient to pay interest on the outlay necessary to install a pasteurizing plant at each of the 388 cheese-factories in New Zealand.

It will, of course, be evident that the full benefits of pasteurization cannot possibly be obtained unless the work is well and carefully carried on throughout. There are some points in connection with the working of the pasteurizing plants and manufacture of the cheese which require careful attention if the best results are to be obtained.

A temperature of 160° to 165° should be aimed at, and the machines in use are so well constructed that if reasonable care is exercised no difficulty will be experienced in maintaining an even temperature between these points. If the temperature of the milk be permitted to fall below 160° the injurious germs are not destroyed, and one of the chief benefits to be derived from the system of pasteurization is, of course, lost. On the other hand, if the temperature is allowed to rise much above 165° the casein-content of the milk is so injured that the curd obtained loses its cohesive properties to a very great extent. Such curd will remain more or less broken during the process of manufacture, and will result in a mealy-bodied cheese. Many of the faults found in some lines of cheese made from pasteurized milk have been directly traced to irregular heating of the milk. It will thus be apparent that the maintenance of an even temperature when pasteurizing is of the utmost importance.

The question of cooling the milk prior to adding the rennet is perhaps as important as that of heating. Instances have been observed where the rennet was added when the milk was at a temperature of 98°. In some cases this was due to the fact that the regenerator was operated considerably above its proper capacity, with the result that the quantity of milk passing over the cooler was so great that proper cooling was impossible. The remedy in such cases is the installation of another machine. It is almost impossible to properly cook a curd obtained from milk which was at a temperature of 95° to 100° at the time of adding the rennet. In working such material there is a considerable loss in yield, and the ultimate result is a weak-bodied inferior-quality cheese. The best results are obtained with a setting-temperature of 86° to 88°, and on no account should it be higher than 90°.

Several experiments have been carried out with a view to determining the amount of extra rennet, if any, required to coagulate pasteurized milk. The results of these experiments prove that practically no increase in the amount of rennet is required, as an equally good coagulation was in most cases obtained by using the same amount of rennet in pasteurized as in unpasteurized milk.

With careful attention given to the points mentioned, and the use of only a first-class starter, an experienced cheesemaker will find no difficulty in the manufacture of a high-grade cheese from pasteurized milk.

Perhaps the best indication of the popularity of this system of cheese-manufacture is to be found in the fact that, although prior to the season 1914-15 the pasteurization of milk for cheesemaking on a large scale was practically unknown in the Dominion, there are at present 141 of such pasteurizing plants in operation, and more are being installed. There is no doubt that the general adoption of pasteurization will be of the greatest benefit to the cheesemaking industry of New Zealand, and it may be confidently anticipated that in a very short time a pasteurizing plant will be considered a necessary part of the equipment of every cheese-factory.

In conclusion, it should be impressed upon dairy-farmers that although a pasteurizing plant may be installed at their factory the necessity for a clean, sound milk-supply is in no way lessened. Under no system of manufacture can the highest quality of cheese be obtained unless the milk is delivered in good condition.

TESTS WITH UNFRUITFUL PLUM-TREES.

THE experiments with unfruitful plum-trees, outlined in the March, 1919, *Journal*, have been continued in Mr. E. F. Sibeth's orchard at Clive Grange, Hawke's Bay. In order to further test the value of inter-pollination one silver-prune was transplanted in the centre of the greengage block, and one greengage was transplanted adjacent to the silver-prunes. During the flowering-period of the greengages, blossom wood of Pond's Seedling and Reine Claude de Bavay was placed in jars in two trees. One more colony of bees, making a total of six, was placed in the orchard. Mr. W. M. Rice, Orchard Instructor, Hastings, reports that the pruning, ring-barking, and root-pruning carried out the previous season, and detailed in the published report, had no effect on the crop whatever when compared with those trees not treated. The silver-prunes had little or no blossom this past spring, while most of the greengages had a fair amount of bloom. The value of interpollination was again confirmed. The crop throughout the block, other than under the influence of the introduced bloom, is nil. A good setting surrounds the Pond's Seedling wood, particularly in close proximity to the bottles, while a light setting surrounds the wood of Reine Claude de Bavay. The transplanting of the silver-prune into the greengage block, and *vice versa*, proved of no value, as the trees had little or no bloom.—*Horticulture Division*.

FRUIT COOL STORAGE.

EXPERIMENTS WITH APPLES AND PEARS.

G. ESAM, Acting Assistant Director, Horticulture Division.

THE export of apples from New Zealand having been stopped during the war owing to shortage of shipping-space, the local markets were called on to absorb the whole of the output from the orchards. This was made possible only by a large increase in cool storage, thereby greatly extending the season for marketing. Following up the indication given on page 344 of the *Journal* for December, 1918, the Horticulture Division undertook during last season comprehensive experiments in picking, handling, and packing fruit for cool storage in order to assist growers and the cool-storage companies to improve their working practice.

To get the best out of cool storage the fruit must be placed in store in the very best condition. A great variation—no doubt due to the different methods adopted by the individual growers in picking, handling, and packing the fruit for storage—has been noticed in the same variety when stored in the same chamber. The experiments certainly indicate that if growers will perform their portion of the business carefully and well the cool stores can be relied on to turn out an article in good condition.

The leading features of the experiments were as follows: To ascertain the best time to pick the leading commercial varieties for storage; to ascertain the best means of picking and handling the fruit to ensure a minimum of bruising; to test the effect on fruit of delay from a few days up to two weeks between the time the fruit is picked and placed in storage; and to ascertain if there is any advantage in wrapping the fruit or lining the cases with paper.

The experiments were undertaken in Hawke's Bay, and the fruit was placed in the cool stores of both the Hawke's Bay Fruitgrowers (Limited), and Apsey, White, and Co. (Limited). Arrangements were made with growers to purchase the whole crop from certain trees in their orchards, and this enabled two or three pickings to be made from the same trees. The fruit, with the exception of one variety, was stored in bushel cases, and the full test comprised some 280 cases.

As there are two distinct types of fruitgrowing lands in Hawke's Bay the tests were duplicated with fruit from trees grown on both classes of soil. For the purposes of convenience the two types will be referred to as the "hill country" and the "flat country" respectively. The former comprises the medium soils, such as found on the slopes of Havelock North, while the latter comprises the rich dark soils of the plains. Generally speaking, fruit grown on the plains has a tendency to grow larger and develop less colour than fruit grown on the higher country.

Shortly after the experiments were commenced departmental arrangements took the writer away from the district, and the work was carried

on by Mr. W. H. Rice, Orchard Instructor, Hastings, who took all records and supplied the notes on which this report is based. All dates refer to the year 1919.

STAGE OF RIPENESS AT WHICH TO PICK.

Apples.

There is a great tendency to pick early, so as to keep the number of windfalls down to a minimum. Throughout the picking tests the first picking corresponded with the main early picking in the district, and was tested against fruit picked from the same or similar adjoining trees a little later. In nearly all instances a second and third picking was made. The fruit was placed in the cool chamber the same day that it was picked. All pickings were taken out of store together, so that a fair comparison one against the other could be made.

The ideal condition in which to withdraw fruit from cool store is while it is still crisp and juicy and before it becomes dry and mealy. An effort was made to withdraw the fruit from store while it was in its best condition, or at about the average storage period for the respective varieties.

Gravenstein.—All fruit was taken out of store and examined on 28th April.

First picking (hill country, 25th January; flat country, 3rd February): Fruit was lacking in colour and inclined to have green tinge, pips only light brown. Larger fruits showed bitter-pit. All inclined to wither and show sponginess instead of ripening.

Second picking (hill country, 6th February; flat country, 12th February): Better colour than first picking. Much better stage for storage; very little sponginess when taken out of store. Crisp and juicy and not mealy after fourteen days. Traces of bitter-pit in all sizes.

Third picking (hill country, 12th February; flat country, 17th February): Best colour, more striped and attractive. Ready for immediate use from store, but did not keep as well out of store as second picking, particularly from the orchard on the flat. Less bitter-pit in this picking.

The average loss of weight in storage was $1\frac{1}{2}$ lb. to $1\frac{3}{4}$ lb. per bushel case. The second picking stored the best. The third picking was more attractive-looking, but went soft and mealy very quickly out of store. The wrapped fruits gave the best results.

Cox's Orange Pippin.—Taken out of store and examined on 14th May. Test was made on fruit from both the hill and flat country.

First picking (25th February): Fruit lacked colour and was unattractive; about 75 per cent. developed bitter-pit, particularly in fruit over $2\frac{1}{2}$ in. Inclined to shrink and went spongy after seven days out of store; even the best specimens shrank rather rapidly.

Second picking (6th March): Yellow body-colour developed, but blush and stripe not pronounced. Less bitter-pit than first picking, but much worse in fruit from the flat country. Larger fruit inclined to mould in the eye, but on the whole texture was fairly firm when taken from store.

Third picking (18th March): Good samples. Blush and stripe predominated, particularly on the hill country. Smaller fruits in best condition from hill country. Fruit from flat country ripened quickly during latter part of storage. Larger sizes went musty, though of good appearance. Some of the medium-sized fruit went brown towards the core after four days out of storage. Although the weather was clear and warm at picking, some 10 to 12 per cent. from both orchards showed mould in the calyx, which did not penetrate to the core.

There was not much difference between the second and third pickings, which were a decided improvement on the first. For long storage the second picking would be the best, but for short storage the third picking would turn out the best-quality fruit in good condition. Well-matured, medium-sized fruits stored the best.

Jonathan.—Taken out of store and examined on 27th May.

First picking (11th March): Well-coloured fruits in this picking kept well, while the greener and less matured fruits showed a marked shrinkage, particularly those that were russeted with bordeaux. Some well-coloured fruits that should have been picked but were allowed to remain on the trees another nine days became soft and mushy under storage.

Second picking (20th March): This picking developed surface bruise rather badly. Went off rather quickly out of store, only the smaller-sized, well-coloured fruits remaining firm.

Third picking (27th March): Was rather a mixed lot, and no reliable comparison could be made with the fruit from the flat country, which was poor in colour. Fruit after fourteen days out of storage went soft and mushy.

The average loss of weight per case was 1½ lb. It was noticeable no bitter-pit or Jonathan spot developed in storage. It was apparent that fully developed and coloured fruits should be picked early for storage, and not left on the tree to develop high colour, as they then go mushy when stored. The smaller-sized fruits stored the best.

Dunn's (Monroe's) Favourite.—Taken out of store and examined on 20th June.

First picking (26th February): Poor colour and developed up to 15 per cent. of bitter-pit in storage, though none appeared to develop after the fruit was taken out. Fruit shrivelled very badly out of storage, and became practically useless fifteen days after removal. Bruised specimens kept fairly well in store, but decayed rapidly when taken out. Fruit from the flat country affected in early stages of growth by frost kept very poorly.

Second picking (hill country, 12th March; flat country, 8th March): The former lot had rather more colour than the first picking, yet behaved very similarly under storage. Fruit from the latter country was a poor lot generally and badly frosted in the early stages of development. Sound specimens shrunk less out of storage, and on the flat country this picking proved the most satisfactory.

Third picking (hill country, 31st March; flat country, 19th March): On the hill country this picking kept best of any lot out of store. It was better matured and shrunk less. Although the third picking on the flat country was better coloured than the former two pickings it went mealy after seven days out of store.

Unlike the other varieties, the Dunn's from the two classes of soil did not behave in a similar manner. Frost injury on the flat country may have caused the variation. Frosted fruits clearly proved no use for storage purposes. The average loss of weight in storage was 2 lb. per case. Bruised fruit stored well, but decayed quickly out of store. Fruit ripened on the tree became mealy soon after withdrawal, while underripe fruit shrank very badly.

Delicious.—Taken out of store and examined on 19th August. The fruit on the flat country lacked colour compared with the hill fruit. This can be attributed to some extent to the trees on the flat being denser than those from which the fruit was taken on the hills. The exposed upright arms on the flats showed up to 75 per cent. of colour.

First picking (25th March): Kept in excellent order and ripened up well. Fruits over 3 in. bruised more rapidly than smaller sizes. Considerable mould developed in the eye, though the fruit was perfectly dry when picked and stored. Fruit ready to pick at this picking, but allowed to remain on the trees till 9th April, developed very rapidly when taken out of store and became rather mealy after fourteen days. The first picking proved the best, particularly from the hill country.

Second picking (9th April): Although very similar to the first picking, the fruit was perhaps softer and bruised more easily. Slightly better colour than the first picking.

Third picking (16th April on the hill country, and 23rd April on the flat country): While the colour was deficient in this picking the fruits proved more matured and riper than is advisable to store, although at picking-time there was no high colour to indicate ripeness. This picking was ready for use immediately out of store, but soon afterwards went mealy.

The loss of weight in store averaged 2 lb. per case. The highly coloured fruit in the earlier pickings stored much better than the greener specimens. Later pickings not so satisfactory, while overripe fruit became mealy. Bruises did not decay until removed from store, except with the later pickings.

Sturmer.—Taken from store and examined on 6th October.

First picking (7th April): Well-coloured specimens stored well, but all other fruit shrivelled badly and thus proved unsuitable for storage.

Second picking (15th April): Again the undeveloped fruit shrank very badly; only the better-coloured fruits stored well.

Third picking (23rd April): The blush and ground colour was fairly well developed. Fruit was more subject to bruise than the earlier pickings. The smaller fruit was not so inclined to shrivel as the earlier pickings. On the whole this picking was inclined to be overripe when removed from store.

This variety demonstrated the direct advantage of grading the fruit for storage, selecting the better-coloured fruit from the earlier pickings for long storage, and using the less-developed fruit for shorter storage. Average loss of weight per case, 1½ lb.

Dougherty.—Taken from store and examined on 17th November.

First picking, 22nd April; second, 3rd May; third, 11th May: There was no noticeable distinction between fruits of equal maturity

in the three pickings. In the earlier pickings fruits with undeveloped ground-colour were the only ones inclined to shrink. Fruits allowed to remain on the trees till nearly ripe were more bruised and mealy when removed from store. The fruit from the orchard on the flat country was russeted, and it was noticeable that this class of fruit appeared to shrink from this cause. Average loss of weight per case, $2\frac{1}{2}$ lb.

White Winter Pearmain (McMahon's White).—This variety is doing particularly well at the Arataki Horticultural Station. One picking was made on 16th April, and the fruit graded into two stages of maturity according to the ground-colour. The fruit stored well up to 15th September, which proved the maximum storage period for fruits well matured when picked. Those not quite so advanced at picking-time held up better after removal from store. Compared with Sturmer this variety ripens to a similar condition in storage fully three weeks earlier, and would thus provide a distinct marketing-period.

Summary for Apples.

Fruits which had attained that stage of maturity which is denoted by the distinct change of ground-colour proved most satisfactory to handle and cool store, while fruits which had attained full size but did not show the change of ground-colour were inclined to shrivel and go sleepy, and, although they ripened, the resultant colour was below standard for the variety. Fruits which were well advanced and showed a high percentage of ground-colour, though certainly the most "fancy" fruits for early sales, went mealy when stored for the average period of the variety, and collapsed quickly out of store, as well as being more susceptible to bruising.

To get the best out of cool storage the necessity of going over each tree several times and selecting only those apples with a distinct change in the ground-colour was demonstrated. For storage it is inadvisable to allow apples to attain a full blush on the tree once the change in the ground-colour has taken place. Russeted apples should be stored separately and withdrawn earlier than the clear-skinned fruit.

Pears.

Three varieties of pears were picked and stored under similar conditions to the apples. Two early varieties and one medium late were used for the test. Again an effort was made to gauge the best time for picking.

Williams Bon Chrétien.—Three pickings were made from an orchard on the flat country, on 7th, 19th, and 24th February respectively. All the fruit was taken out of store and examined on 2nd April. No marked difference in the maturity of the fruit could be observed at this stage, but as the fruit ripened and became ready for sale a distinction between the various pickings was noted. The first picking was fairly good up to fourteen days, then became soft and puffy. The second picking was good up to fourteen days, then soft and mellow. The third picking showed bruise badly, and after about six days a skin-rot developed.

The average loss of weight per case was $\frac{3}{4}$ lb. A certain amount of scald developed on all the pickings, but it was less evident on fruit which was pre-cooled.

Louise Bonne of Jersey.—Four pickings were made from an orchard on the flat country, on 14th and 21st February and 3rd and 10th March respectively. All fruit was taken out of store and examined on 29th April.

First picking shrivelled very badly at the stem end—even the best specimens. The average loss of weight was 3 lb. per case.

Second picking did not shrivel to such an extent as the first picking, but still shrivelling was considerable. There was a marked difference in the amount of bruise, which indicated that careful handling becomes more important as the fruit matures. Average loss of weight, $1\frac{1}{4}$ lb. per case.

Third picking was well-developed, good-coloured fruit. Texture was firm and flavour fair, which was lacking in the two earlier pickings. Bruise developed rather badly in store. Average loss of weight, $\frac{1}{2}$ lb. per case.

Fourth picking was most satisfactory. It was of good colour, full flavour, and very firm texture. There was no noticeable shrinkage, yet the loss of weight averaged 1 lb. per case. Any picking or packing bruise showed up very quickly when taken out of store.

This variety showed no skin-rot, so noticeable in Williams. The first picking can be said to be valueless for storage. The second picking was leathery in seven days after withdrawal from store. The third picking was soft and mellow after seven days, but became dry in twelve days. The fourth picking was even better, being sweeter at seven days, but had little flavour after the twelfth day.

Winter Cole.—Three pickings were made from one orchard, on 25th March and 1st and 10th April respectively. They were taken out of store on 4th August, the average loss in weight being $1\frac{1}{4}$ lb. per case. As no appreciable difference was observed when examined in store from time to time the fruit was kept in store until it was fully ripe, and was even then a very even lot throughout. A slight shrivelling was observed only in a few immature fruits.

HANDLING TEST.

A comprehensive handling test was conducted in the scheme of experiments, and, as would be expected, this factor proved to be a very important feature in connection with cool storage of fruit. To enable a reliable comparison to be made all the foregoing varieties of apples and pears came under the scheme, and as far as possible the test was carried out with each picking of the variety. Not only was a report made on the handling at the time the fruit was taken out of the store, but it was marketed in the usual manner, and a further report was made by an independent officer at its destination. The handling test comprised the following methods:—

(1.) Fruit picked carefully in the usual manner into a picking-bag, then emptied in the ordinary way into the orchard case, and the case then lightly shaken to settle the fruit. The case was conveyed in this manner to the central packing-shed. It was then topped off and a lid put on.

(2.) Case topped off and lid nailed on in the orchard, otherwise the same handling as (1).

(3.) Fruit picked carefully into picking-bag and emptied carefully into bulk case or orchard case. Fruit was then lightly packed from this case into another case on the diagonal or pocket-pack method with wood-wool top and bottom. (Note.—This method could have been improved by using a grading or packing table under the shade of the trees.)

(4.) Fruit picked and packed on the diagonal or pocket-pack method direct from the tree into case with wood-wool top and bottom.

Fruit handled under each method was taken to the cool store in the same conveyance and placed in store together. (1) and (2) were packed for market after they were taken out of store. (1) represented the usual method adopted in the district of picking and conveying the fruit in open cases to the central packing-sheds, which are run in conjunction with the cool stores, much of the fruit being usually placed promptly into the cool chambers and graded and packed when taken out.

The following observations were made regarding results under the several methods :—

(1.) Fruits in all pickings and stages of development showed a very marked increase in bruising over (3) and (4), due to the fruit rolling and settling down in the case during transit. Bruising was particularly noticeable in Gravensteins. Even such a good cool-store variety as Sturmer bruised badly under this method. The same bruising on pears was also evident.

(2.) Very similar condition to (1). Eight or ten fruits could be placed in each case when they arrived at the store, even though a little lid bruise showed on some fruits, showing that the cases were well filled in the orchard.

(3.) This method proved satisfactory, and showed little or no handling-bruise except in specimens well advanced in maturity. A marked improvement over (1) and (2), even with Sturmers.

(4.) Proved the most satisfactory and showed least amount of handling-bruise, but not sufficient improvement on (3) to warrant commercial practice except with fairly ripe fruits intended for short storage.

This portion of the experiments emphasized the great importance of handling the fruit carefully and doing everything possible to ensure it being placed in cool store in the best possible condition. Much damage was done to fruit loosely packed in cases and carted in this condition to the cool stores. The advantage of the orchard pack was very evident both with apples and pears.

COOL STORING PROMPTLY AFTER PICKING.

A further series of tests was made with the same varieties to observe the effect of promptly placing fruit in cool store after it is picked. The following formed the basis of the experiments :—

(1.) Fruit was kept in closed cases in the shade of the trees for various periods, ranging from five to seven days with early varieties and up to twenty-one days with late varieties.

(2.) Fruit was kept in packing-shed under same conditions as (1).

(3.) Fruit was delayed in closed cases in the orchard for various periods, then further delayed in the packing-shed.

(4.) Fruit was allowed to remain exposed to the direct rays of the sun for short periods after being picked and put into orchard boxes.

Check cases of fruit, picked and packed from the same trees under identical conditions but placed promptly in cool store, were used throughout for comparison.

A decided advantage in placing fruit promptly in store was forcibly demonstrated. In the earlier pickings with each variety even a short delay caused the fruit to shrivel and shrink and become leathery, which was intensified the longer the fruit was delayed before being put into store. With the later pickings, where the fruit was more matured, the delay hastened ripening in each variety. It was observed that this class of fruit was inclined to develop decay where bruised, and the decay appeared to spread in storage, while similarly bruised fruit which was placed promptly in storage developed decay only when removed from store.

The loss of weight was greater in fruit that was delayed before being placed in store. Dunn's (Monroe's) Favourite showed a loss of $4\frac{1}{2}$ lb. per case. With Delicious the delay hastened ripening rather than caused shrivelling, while with Sturmers shrivelling was more pronounced. With pears, particularly Williams, delay proved very injurious.

No noticeable difference could be observed in the method of delay indicated in (1) and (2). If anything, the double delay in (3), even for the same period as (1) or (2), proved more detrimental. Codlin-moth grubs were found in (1) cases delayed in the orchard.

Exposure to the sun's rays (4), even for a couple of hours, proved so injurious to the top layers in the cases of the early varieties that it was not continued.

WRAPPING FRUIT.

Apples that were wrapped and packed before being placed in cool store were of brighter general appearance and colour than similar unwrapped fruit from the same trees placed in store at the same time. This was noticeable with all varieties; even the early Gravensteins and the long-keeping Sturmers behaved alike. Although the wrapped fruits were riper they retained firmness of texture equally with the unwrapped. Wrapping did not influence or retard the development of bitter-pit, and its effect on decay could not be determined, as all the fruit used throughout the wrapping test was very carefully handled.

The effect of wrapping the different varieties of pears was inconsistent. Nothing could be made of the Williams pears; all except one wrapped case were a failure. The wrapped Louise Bonne of Jersey pears appeared to develop a little more colour than the unwrapped, while wrapping the Winter Cole pears delayed their ripening.

Cases lined throughout with a double thickness of newspaper showed no marked variation from similar cases not so lined, but the fruit lacked the brightness of skin so evident in that which was wrapped singly.

INJURIES TO FRUIT.

Apart from the bruising already dealt with in connection with the handling test stem-punctures were prevalent on fruit that was not

carefully handled. The loss of the stem did not cause decay unless the tissue of the fruit was torn. Fruits affected by frost in the early stages of their development shrunk badly when compared with those not affected.

HILL COUNTRY AND FLAT COUNTRY.

As already indicated in the early part of this report, fruit grown on the rich soil of the flats was tested against fruit grown on the medium soils, such as the slopes of the Havelock Hills. The orchards on the plains were more affected by frost than those on the slopes, and as a result the crops were very inconsistent and generally light. Although a special effort was made to select trees on the flats and slopes carrying about the same crops it was found almost impossible to do this, as the fruit on the richer lands of the flats was inclined to oversize, owing to the lightness of the crop. The results were inconsistent, and no comparison of value could be made.

CONCLUSION.

The results of the experiments clearly demonstrate the important part the orchardist has to take in the ultimate success of the cool storage of fruit. Only by strict attention by the grower to picking the fruit at the right stage of maturity, handling it in a careful manner, keeping it out of the sun once it is picked, the elimination of bruising during conveyance to the store, and placing the fruit promptly in store after it is picked can success be assured. If careful attention is paid to these details the stores can then be expected to do their part of the business in an efficient manner. It certainly appears evident from the experiments that a good many faults attributed to cool storage lie in the unsatisfactory condition in which fruit is often placed in store.

It is proposed to continue the experiments this season. The stage of maturity at which the fruit is picked and wrapping against non-wrapping will be the leading features. Two pickings of apples and three of pears will be tried, but the fruit from each picking will be graded into two grades for maturity. The handling test will be confined to grading and packing in the orchard or the orchard packing-shed, as against conveying the fruit in orchard boxes to the stores and then grading and packing before storing. Russeted fruits from the same trees will be stored separately from the clean-skinned fruits. One or two additional varieties of pears will be tested.

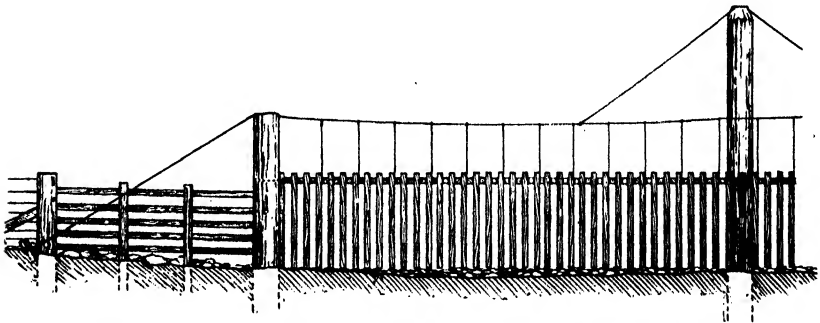
The success of the experiments here recorded is in no small measure due to the personal efforts of Mr. Rice, and to the co-operation and valuable assistance rendered by the managers of the two cool-store companies at Hastings.

Forestry Articles.—Under the heading "Dissemination of Forestry Information" the last annual report of the Forestry Department, after commending the work of the Forestry League, remarks, "The Rev. J. H. Simmonds and other observers have at various times contributed to the *Journal of Agriculture* valuable articles on different exotic trees grown in New Zealand, and it is to be hoped that these enthusiasts will continue to publish the results of their observations, which are of much value to the Forestry Department and private tree-growers."

A GOOD TYPE OF FLOOD-GATE.

ON page 272 of the November *Journal*, in an illustration of the Makaretu River, was shown a flood-gate constructed on a very practical and efficient design by Mr. M. Paulsen, of Takapau. Particulars of this flood-gate, and of smaller ones on the same principle, are given by Mr. Paulsen in the following note:—

The flood-gate is about 6 chains long and in flood-time swings out the whole length in a body, the wire on which the battens are strung not being fastened to any of the posts in the centre or at the ends. All the battens are bored with a $\frac{1}{2}$ in. bit, then threaded on to a cable of about $\frac{3}{8}$ in. gauge. Another cable or wire runs from post to post



BANK END OF LARGE FLOOD-GATE.

The flood-gate can be extended (on right), with posts at intervals, to any reasonable length, according to the width of the stream.

3 ft. from top. From this cable hang down wires hooked on to the wire holding the battens. The cable is anchored at both ends, then put up on top of a post at each end at the height required, above the highest flood-marks. There is also another wire over the top of the posts, fastened in the middle of each span. This takes the weight off the centre of the span, and can always be tightened up without much trouble. As the river rises the battens float on top—however high the water. Only extremely large branches are liable to catch. This flood-gate has been erected six years, and has required no repairs. The down-wires are left long enough to allow them to be raised or lowered according to any alteration in the river-bed. The battens are of white-pine, 3 in. by 2 in., and 5 ft. in length. To make the flood-gate lighter a short piece is bored and placed in between each batten on the same wire, leaving the battens about 4 in. apart. The piles are 12 in. by 12 in., totara, driven 8 ft. into the ground. I got them driven while the bridge was being built. Previous to the erection of this flood-gate

the fences used to be washed down at every flood, and caused great expense and endless inconvenience during busy seasons.

I also make flood-gates on the same principle for smaller streams. Where there is only one bank available, either a railway-iron or high post is used to get the height. In other cases no posts are used, the



SMALL FLOOD-GATE.

The dark post on right is a railway-iron. In this flood-gate there are two overhead wires, one above the other, connected by down-wires at intervals.

carrying-wire being fastened to a tree on each bank. Four-foot or five-foot logs have passed under these gates without doing damage. The battens must rest on the ground, otherwise in windy weather there is too much strain, and openings are apt to be left where stock can get through. Sometimes I put a wire on the down-stream side of the battens, stapled on to keep them in their place.

Milk-products Investigation.—Mr. W. Dempster, of the Dairy Division, returned this month from his visit to America and Europe. Reports on his investigations will be published in due course.

Instruction in Pig-keeping.—This important branch of live-stock husbandry, which has been declining in New Zealand for some years past, will be dealt with in future by the Department through a special Instructor in Pig-keeping, under the Live-stock Division, Wellington. The position has been filled by the appointment of Mr. K. W. Gorrings, who is well known as an extensive pig-raiser in Taranaki, Waikato, &c., and brings a large fund of practical experience to his new duties. He will travel in the various country districts.

TESTING OF PUREBRED DAIRY COWS.

CERTIFICATE-OF-RECORD LIST FOR DECEMBER.

W. M. SINGLETON, Assistant Director of the Dairy Division.

IN the appended list, comprising all available records completed in December, are shown the performances of a number of cows and heifers the larger proportion of which commenced their lactation period later in the milking season than was the case with the animals appearing in recently published lists. The present records represent the production of quite a number of yearlings in the junior two-year-old class. When the age is considered it must be conceded that many of these productions are very creditable.

JERSEYS.

From the point of view of maximum production and margin over requirement to qualify the yield of Hill Belle merits special reference. She is a daughter of Eminent's Fontaine (imp.), who now has twenty-one C.O.R. daughters. Her dam was Silver Light, a daughter of Starlight, and therefore half-sister to Sabean III, who has a C.O.R. for 625.38 lb. butterfat. Silver Light is also half-sister to Starlight II, the sire of Floss V, who has a C.O.R. for 621.40 lb. butterfat.

FRIESIANS.

Queen Colantha Cadilac has the distinction of being the only animal in this list in the 600 lb. butterfat class. She was tested as a senior two-year-old, and is by a son of King Segis Wild Rose Homestead from Friesland Park Colantha Cadilac, a daughter of Dutchland Colantha Cadilac (imp.). Queen Colantha Cadilac is a line-bred cow, since King Segis Wild Rose Homestead appears as her grandsire on her sire's side and as great-grandsire on her dam's side. Her pedigree shows 87½ per cent. from North American strains, including Colantha Johanna Lad. The three nearest dams of Queen Colantha Cadilac have each been on test and have produced well.

Another good record in the senior two-year-old class is that of Martha Johanna Rue. She traces entirely to North American strains, being daughter of Mutual Piebe of Rock (imp.) from Martha Elgin Pauline II (imp.). Her sire and dam were both sired by Mutual Piebe de Kol, who has produced many high-record daughters, including Mutual Pearl of Rock, who in the ordinary course will shortly complete the calving requirement for a C.O.R. for 903.44 lb. butterfat.

In the senior four-year-olds Willem's Koe de Kol has annexed a very creditable record. She is by Colantha Sir Winana (imp.), and thus traces through his sire Colantha Johanna Lad to the high-record cow Colantha IV's Johanna, who was at one time the world's leader with a credit of 998.26 lb. butterfat.

MILKING SHORTHORNS.

The production of Pitlochrie Queenie will attract attention to her breed. The herd-book supplies no pedigree for this cow, consequently further comment is impossible.

RECORDS COMPLETED DURING DECEMBER, 1919.

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

JERSEYS.						
<i>Junior Two-year-old.</i>		Yrs. d.ys.	lb.		lb.	lb.
Melia Ann's Rose ..	W. T. Luxton, Waitara	1 350	240.5	365	7,644.4	467.95
Aster's Fair Lady ..	James Nicolson, Kaipokonui	2 83	248.8	364	9,577.0	457.31
Koro Koro Silky ..	R. W. Southec, Kiwitea	1 329	240.5	365	8,895.5	452.10
Golden Fern's Queen	T. Dixon, Masterton..	2 3	240.8	365	7,727.6	441.86
Miro Meadows Fay	R. W. Southec, Kiwitea	2 39	244.4	365	7,773.4	438.17
Twinkle ..	E. B. Eagle, Carterton	1 313	240.5	365	7,822.0	425.58
Aureola ..	V. W. Nowell, Hawera	1 336	240.5	365	7,174.4	408.07
Copper Coin of Woodstock	H. Livingston, Kiwitea	1 327	240.5	365	7,256.5	402.52
Miro Meadows Dot ..	A. A. Ward, Tariki ..	1 356	240.5	365	6,536.4	395.85
Middlewood's Molly	H. Livingston, Kiwitea	1 308	240.5	365	5,363.9	372.43
Bonnie Queen ..	E. B. Eagle, Carterton	2 15	242.0	365	6,897.7	364.23
Ivy Fox ..	F. E. Day, Tamahere	1 336	240.5	365	6,325.9	353.86
Oakland's Patchless	J. Hartstone, Te Kowhai	2 59	246.4	265	5,321.7	321.13
Jerseydale's Queen Bess	J. Pettigrew, Pihama	2 10	241.5	363	5,072.0	296.50
Delight of Willowbank	Ranford Bros., Stratford	1 345	240.5	312	5,624.4	294.45
<i>Senior Two-year-old.</i>						
Trelawny Clematis ..	Thomas Church, Te Rapa	2 352	275.7	357	7,751.8	349.86
Flora's Silverlocks ..	J. G. Harkness, Wellington	2 107	251.2	308	5,348.3	333.04
<i>Three-year-old.</i>						
Hill Belle ..	A. C. Lovelock, Woodville	3 295	306.5	365	9,355.2	578.27
Aster's Vanity ..	James Nicolson, Kaipokonui	3 5	277.5	365	8,234.8	473.00
Waipiko Christina ..	L. M. Barriball, Waiuku	3 353	312.3	278	7,199.1	446.46
Beachland's Rose ..	A. C. Lovelock, Woodville	3 39	280.9	293	6,891.2	353.77
Disdain's Twilight ..	F. Gough, Awakeri ..	3 118	288.8	201	4,746.4	293.91
<i>Four-year-old.</i>						
Olga's Sweetheart ..	R. J. Linn, Normanby	4 64	319.9	273	7,282.6	432.21
Freesia Day ..	F. Gough, Awakeri ..	4 54	318.9	274	7,286.0	367.78
<i>Mature.</i>						
Kairona ..	R. C. Leach, Woodville	5 11	350.0	357	7,439.45	458.65
Gowan ..	H. Livingston, Kiwitea	7 81	350.0	365	7,224.0	403.69

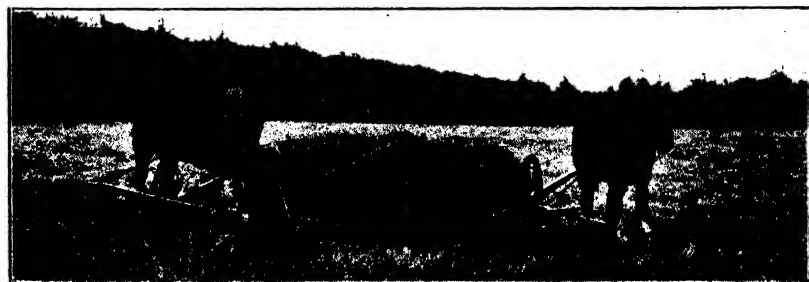
FRIESIANS.						
<i>Junior Two-year-old.</i>						
Lakeview Princess	C. A. Fawcett, Clevedon	2 113	251.8	365	12,625.4	384.26
Kroons						
Colantha Gift ..	T. W. Crossen, Selwyn	1 357	240.5	259	8,612.3	275.95

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
FRIESIANS—continued.						
Senior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Queen Colantha	W. I. Lovelock, Palmerston North	2 255	266·0	365	15,887·5	614·97
Cadillac						
Martha Johanna Rue	W. Barton, Featherston	2 286	269·1	364	14,880·1	509·11
Senior Four-year-old.						
Willem's Koe de Kol	W. I. Lovelock, Palmerston North	4 219	335·4	365	15,023·2	556·49
Mature.						
Oakwood Rambler ..	W. D. Hunt, Invercargill	5 274	350·0	345	15,035·8	482·08
MILKING SHORTHORNS.						
Two-year-old.						
Rushmere Darling ..	W. H. Brewster, Feilding	2 8	241·3	365	6,518·1	259·32
Mature.						
Pitlochie Queenie ..	D. H. Kilgour, Feilding	*	350·0	365	14,217·9	584·61
Lillydale Violet ..	R. C. Leach, Woodville	*	350·0	362	9,705·65	466·75
Blossom ..	J. C. Hearsey, Longburn	*	350·0	365	11,134·6	457·73
Monavale Dairymaid	H. W. Giles, Monavale, Cambridge	*	350·0	365	12,392·7	452·84
Corriblea Tulip ..	M. Creaven, Taikorea	*	350·0	365	10,673·6	432·17
Parrot 1 of Myrtle	A. Feierabend, Dannevirke	*	350·0	317	10,992·9	389·47
Woodlock Maid ..	J. R. Anderson, Foxton Line	5 21	350·0	291	9,712·2	382·71
Fussie 1 of Myrtle	A. Feierabend, Dannevirke	4-5	350·0	315	8,428·6	374·72
Nancy 1 of Myrtle	A. Feierabend, Dannevirke	*	350·0	319	9,250·5	364·47

* Mature.

NOTE.—A supplementary list, completing the records for 1919, will be published next month.



THE FRUIT INDUSTRY OF NORTH AMERICA.

CO-OPERATION AND STANDARDIZATION.

J. A. CAMPBELL, Assistant Director of the Horticultural Division.

CO-OPERATIVE ORGANIZATION.

THE fruit industry of Canada and the United States, particularly in the western areas, was never in its history more prosperous than at the present time. This prosperity is largely due to the co-operative movement, which although not new, particularly as regards California, has been brought to a successful issue in most instances only during the last few years.

For twenty years previous to this era of successful co-operation the lot of the Californian fruitgrower was a precarious one, fluctuating according to season, but the general tendency was from bad to worse. The growers were largely at the mercy of the eastern buyers, who, through lack of organization among the producers, were in a position to largely control the means of transportation. The more progressive growers realized early in this period that relief could be found only in co-operation, consequently such societies were formed from time to time, but with one exception they invariably failed through one cause or another, such as inexperience, outside influences, want of loyalty on the part of members, lack of economy, &c., and went out of business in the course of one or two seasons. Each failure naturally increased the difficulties of subsequent efforts.

The exception referred to was the present California Fruitgrowers' Exchange, an organization brought into existence some sixteen years ago in the interest of the citrus industry of California, and now the oldest and undoubtedly the largest and most successful fruit-industry co-operative concern in America. The object-lesson taught by this association, together with the absolute necessity for relieving the disastrous position into which the industry generally had fallen, were instrumental in bringing about the more recent and successful movement in co-operation. At the present time such societies are to be found in practically every fruitgrowing district of any consequence in western North America. The majority are undoubtedly highly successful, and are growing stronger every year. Although they vary considerably in detail the fundamental principles governing possibly nine-tenths of them are based on those of the California Fruitgrowers' Exchange.

Practically the whole of the co-operative societies are formed on a non-profit-making basis. All the expenses of running the concern are derived from the fruit handled, and all the profits are returned to suppliers *pro rata*. A fixed rate of interest (7 or 8 per cent.) is usually arranged at the outset to be paid on all money in the form of shares held by the company, but this does not always apply. In cases where shares are held only by suppliers, and the number fixed on the acreage basis and paid by a case-levy on all fruit supplied, there is little to be

gained by paying out interest, to furnish which a heavier tax must be placed on the recipient's own fruit. This is now the popular means of financing such concerns.

In cases where shares are taken up regardless of the quantity of fruit supplied by the shareholders, and particularly in cases where the association packs fruit for growers other than shareholders, the payment of interest is, of course, necessary. These organizations are established under two distinct heads, and may be termed "complete" and "incomplete," each of these being divided into two classes.

The "complete" organization is one that packs and sells the fruit of its members. This is usually done through a chain of comparatively small associations, finally uniting in the form of a selling organization. The functions of the smaller associations are to prepare and pack the fruit for sale. Each one is complete in itself, the board of directors of the selling organization being elected from the directors of the whole. At the same time, although directly connected in this way, the selling organization is quite distinct from a legal standpoint. Such selling organizations usually become what are practically very large co-operative wholesale stores buying at advantageous rates practically everything required by its members.

Where such trading is done, however, the principle usually observed is not to directly undercut local merchants, but to fix a price that will leave a fair margin of profit, and then to notify the merchants of the prices at which the company intends doing business for the year. At the end of the year all profits made in the different departments are rebated to each member in accordance with the amount of his purchases through the company. The California Fruitgrowers' Exchange, the Okanagan Fruitgrowers' Union (British Columbia), and others operate in this way.

Class two of the complete organization is the co-operative concern which assembles, packs, and sells the fruit supplied by its members, much in the same manner as our co-operative societies in New Zealand. It is generally recognized, however, that this class is the most difficult to carry on successfully unless it is undertaken in a large way and the supply of fruit handled is sufficient to keep the overhead expenses, such as management, agency connections, advertising, &c., within reasonable limits.

The "incomplete" organization is one that is formed for the purpose of grading, packing, and preparing its fruit for sale only, and which then hands it over to an entirely separate concern for purposes of sale. Notable examples of this class are the Cashmere, Peshastan, Entiat, and Spokane Fruitgrowers' Unions in the western United States. Each of these concerns handles from half a million to over a million cases of fruit and sells exclusively through the Nor'-west Fruit Exchange, a proprietary concern with headquarters at Seattle.

The Nor'-west Fruit Exchange is the largest selling organization of deciduous fruit in North America. Its selling-charge is 10 cents per case, and out of this it maintains paid agents throughout practically the whole of North America.

The second class is an organization made up of fruitgrower shareholders and established for selling purposes only. It has nothing to do with packing, other than to employ inspectors to check the packing and to see that its members pack according to the State or its own

standard requirements. This form of association buys and sells and rebates all profits to its members in the same manner as the first.

In Canada commercial fruitgrowing is treated as a Federal Government matter, and the formation of co-operative associations is assisted by a grant of two-thirds the amount subscribed by the growers. In the United States, although strong Federal Government encouragement and support is given, it is mainly an individual State and county matter, and no financial assistance is afforded in the formation of such concerns. In some instances strong financial associations, such as the Shookum Packers' Association, advance money at a low rate of interest for the establishment of buildings and machinery to newly formed societies which affiliate with that association.

Economy or, rather, guarding against extravagance is the first principle in the formation of a co-operative concern. Commitments beyond the proposed company's capacity to meet within a reasonable time are avoided as far as possible in all cases, but particularly so where the supply of fruit to be immediately handled by the company is limited. Indebtedness for buildings and other equipment to meet prospective developments is not incurred until the company has been well tested and the prospective developments become an actual reality.

The general procedure in the formation of a company or packing association is for a number of growers to meet and decide the general lines on which the organization should be formed and guarantee the preliminary expenses. A canvass of the district is then made to ascertain the support and the correct estimate of the fruit the concern will have to handle. The formation of the company is then proceeded with on this basis. The capital is fixed and articles of association drawn out. A reasonable charge per case for the work proposed to be done by the company is fixed. An estimate of running the company is made, including interest on cost of buildings and plant, salaries, wages, &c. This is divided by the number of cases to be handled, and if the result is more per case than the price fixed some pruning is done; this is usually in the direction of reducing the packing-shed accommodation.

Central packing is generally considered to be the ideal method of handling fruit, and it is continually growing in popularity; but where State packing-standardization laws exist it is not held to be absolutely essential. At any rate, in cases of limited resources such as previously referred to it is considered advisable to utilize to a more or less extent the existing orchard facilities and labour rather than run the risk of unduly embarrassing the company at the outset. As the company progresses the additional facilities are provided.

Shares are issued on an acreage basis. These vary, but usually range from six to ten 10-dollar shares per acre. A small amount per share may be paid on allotment, but the remainder is paid by the deduction of a fixed amount—usually 2 cents per case—put through the company on account of the shareholder. At the same time each shareholder signs a certificate termed a "grower's note." This certificate is a very binding agreement relative to the shares held, and is accepted by the banks as collateral security. All further developments of the company are financed on the case-tax basis, but are undertaken only with the consent of the shareholders.

The loyalty of members is a very important factor in the success of a co-operative company. This is recognized, and a rather stringent

agreement is drawn up and signed by each grower. The aim of the American co-operative concerns, however, is not to bind their members against their will, but by the merit and efficiency of the company to make it very much in the interest of the member to remain an active supporter. In pursuance of this policy the agreements referred to are terminated at the end of each season. There are two months between seasons during which a member may, by giving written notification, arrange to dispose of his fruit outside of the company. If no such notification is made during the recognized period the agreement is automatically renewed for another year, in which case all the penalties provided are strictly enforced if occasion arises.

STANDARDIZATION.

All concerned in the American fruit industry are agreed that the business could not possibly have reached its present extensive and prosperous position had it not been for the stabilizing effect of the standard-packing laws. There are at least four grades of apples taken from a tree—first, second, and third grade, and culls. Without standard grading a buyer could not tell, short of personal inspection of each case, which of these or what percentage of each he was buying; consequently trade in a large way would be considerably hampered, or the buyer, to protect himself, would offer much less than the possible worth of the fruit. With standard grading, however, a buyer can safely buy on grade and variety without having seen the fruit at all.

Standard grading and packing operates throughout the whole of Canada. In the United States it is not yet universal, but all the western and north-western States have adopted State standardization laws. These apply to all packers of fruit for market, ample exception being made under what are termed domestic and jumble-pack provisions.

Packages in which fruit is allowed to be sold have also been standardized. Packages have been standardized for the whole of Canada, and all the western part of the United States has adopted more or less similar packages. The standard apple-box, 10½ in. by 11½ in. by 18 in., applies throughout Canada, also in the States of Washington, Oregon, Ohio, Montana, California, and possibly Arizona.

NOTE.—Mr. Campbell returned last month from his visit to America. It is intended, as soon as available, to publish in bulletin form a detailed report covering the whole of his investigations. In the meantime various features, such as the subject of the foregoing article, will be dealt with more briefly in the *Journal*.
—EDITOR.

Wool Instruction for Farmers.—A new position of Wool Instructor has been created in the Department to deal systematically with this side of sheep-farming. Mr. H. H. Chaplin has been appointed to the position, and is attached to the Live-stock Division, with headquarters at Wellington. Mr. Chaplin is well known in wool circles, having had a lengthy practical experience in all branches of sorting, classing, &c., at various large wool-establishments and sheep-stations in the Dominion. He has also twice visited the United States for the special purpose of giving wool-classing demonstrations in that country.

MEASUREMENT OF LAND.

SIMPLE DIRECTIONS FOR FARMERS.

A. MACPHERSON, Fields Instructor, Christchurch.

FARMERS often desire to know the contents of a given area, or to lay off small portions of land for the purpose of experimenting with crops, manures, &c., but find some difficulty in doing it correctly for the lack of a few simple rules to guide them.

The simplest appliances suitable for a farmer to carry out small surveys with accuracy are as follows :—

(1.) A Gunter's chain, which is 66 ft (22 yards) in length, and divided into 100 links, each 7·92 in. long. The more modern steel-band chain measure, having the links marked on one side of it and the feet on the other side, is perhaps the better type, allowing, as it does, of the measurements being taken either in links or feet.

(2.) Ten iron pins or arrows, about 12 in. long, pointed at one end and turned at the other to form a ring or handle.

(3.) A cross-staff, used to ascertain a point on the chain or base line from which a perpendicular will meet an observed point, such as a bend or angle on the boundary-line of a field. This can be made from a round piece of mahogany, boxwood, or other hard timber not likely to warp or split, with a diameter of about 8 in., on which two fine grooves are sawn at right angles to each other. This is firmly fixed to one end of a staff made of ash or hickory, about 1 in. in diameter and about 5 ft. 6 in. in length, the other end being spiked for sticking into the ground (Figs. 1 and 2). Handy metal cross-staff heads (Fig. 3) are also procurable. A simple instrument called the "optical square" is now more generally employed for taking right angles to the chain or base line. It consists of a small circular metal box containing two small mirrors, whose planes make with each other an angle of 45 degrees.

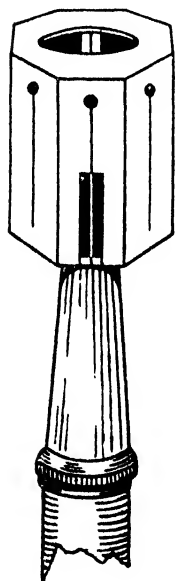
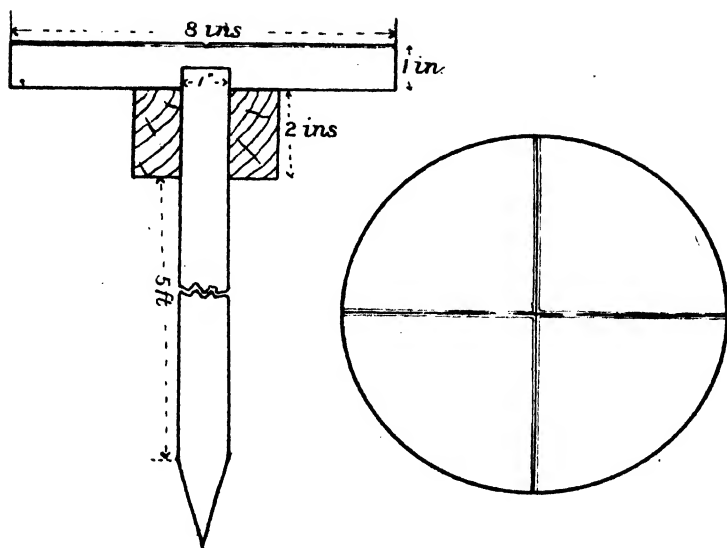


FIG. 3. METAL CROSS-STAFF HEAD.

(4.) A field-book. This book is divided into three columns. In the centre column, beginning at the bottom, are entered the distances successively marked on the chain or base line. In the right- and left-hand columns are entered the perpendiculars from points in the boundary on the right and left of the chain or base line respectively, forming the offsets for side areas. Instead of the foregoing, a good plan is to draw a long line on a page of the field-book, at a suitable angle if required, this to form



FIGS. 1 AND 2. CROSS-STAFF MADE OF WOOD.

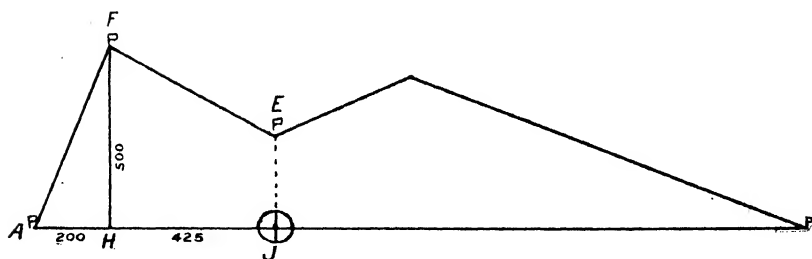


FIG. 4. DIAGRAM OF FIELD BUILT UP AS SURVEY PROCEEDS.

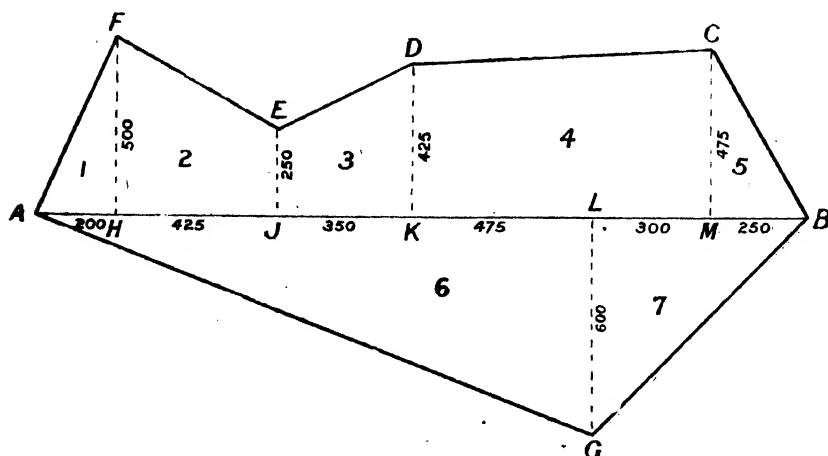


FIG. 5. EXAMPLE OF SURVEY OF IRREGULAR FIELD.

the chain or base line from which the measurements and offsets to right or left are marked. A diagram of the field can be thus built up as the survey proceeds. This method I find to be the simplest and easiest for most farmers to follow and to understand, and it is therefore adopted for the examples hereafter given.

METHODS AND USE OF APPLIANCES.

The base-line should always be taken if possible from the two farthest-away points in the field. To enable offsets to be taken correctly from the base-line a flag should be placed at each point of the line, with one or two flags between in perfect line to facilitate the work.

To use the cross-staff, when taking an offset, the operator places himself on the base-line at a point as nearly a right angle as possible to the object or angle in the boundary-fence which he desires to measure, and, placing the staff in front of him in a direct line with the base-line, sticks the spiked end firmly in the ground. Then, looking along one of the grooves sawn in the headpiece (or, if a metal cross-staff head, through the slots), he adjusts the staff until, on looking both ways, he finds that one of the grooves or slots of the cross-staff

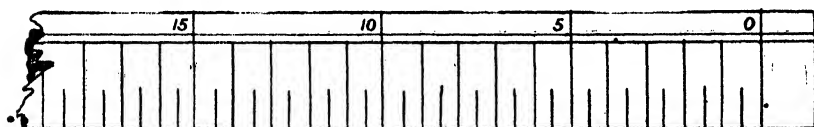


FIG. 6. SCALE OR MEASURE.

points exactly to the flags at both ends of the base-line. Looking along the cross-groove or slot at right angles to the base-line he discovers whether he is at a point on the base-line at right angles with the object or angle he desires to measure to; if not, he shifts the cross-staff either forward or backward along the base-line until he gets the exact position. Fig. 4 shows how the measurements are marked in the field-book and a diagram of the field built up as the survey proceeds. It also shows how the cross-staff is used to find the point on the base-line from which a perpendicular will meet an observed point on the boundary of a field. Having placed a flag at each end of the base-line, the operator begins at A and measures along to a point H on the line, at right angles to the point on the boundary of the field at F. Having ascertained this right angle by means of the cross-staff, the distance—200 links—from A to H is marked in the field-book. Then the perpendicular or offset H to F, 500 links, is measured and marked in the book. The distance, 425 links, along the base-line from H is then measured to a point on the base-line ascertained by the cross-staff at J, at right angles with a bend in the boundary of the field at E, and so on.

SURVEY OF AN IRREGULAR FIELD.

Fig. 5 is an example of the survey of an irregular field, completed and drawn to the different measurements by means of a scale or measure (Fig. 6) and a set-square (Fig. 7).

To compute the acreage multiply the base (in links) of each triangle by its perpendicular height and divide by 2: this gives the area in square links. Point off five figures from the right (that is equal to dividing by 100,000, the number of square links in an acre), which gives acres and decimal fraction. Repeat the process for each triangle, and add together. If it is desired to show the roods and poles, multiply the decimal fraction remaining by 4 (roods in an acre), and point off five figures from the right, which leaves roods; then multiply the decimal fraction remaining by 40 (poles in a rood), and point off five figures from the right, leaving poles with decimal fraction. Example (Fig. 5):—

(1) Angle AH 200 500 HF 2)100000 50000	(2) HF 500 EJ 250 2)750 375 425 HJ 1875 750 1500 159375	(3) EJ 250 DK 425 2)675 337 350 JK 16850 1011 117950	(4) DK 425 CM 475 2)900 450 775 KM* 2250 3150 3150 348750
(5) CM 475 250 MB 23750 950 2)118750 59375	(6) AH 200 HJ 425 JK 350 KL 475 1450 600 LG 2)870000 435000	(7) LM 300 MB 250 550 600 LG 2)330000 165000	Add totals. 50000 159375 117950 348750 59375 435000 165000 acres 13'35450 4 1'41800 40 16'72000

* KL 475 + LM 300 = KM 775.

Total area, 13 acres 1 rood 16 poles.

NOTE.—The area, in square links, of rectangles of irregular shape, but having two sides at right angles to the base-line, such as areas (2), (3), and (4) in Fig. 5, is obtained by taking the average of the two parallel sides and multiplying this by the length of the base-line, as shown in the above calculations for these areas. Thus in (2) $HF\ 500 + EJ\ 250 = 750 \div 2 = 375 \times HJ\ 425 = 159,375$.

MAKING A PLAN FROM THE FIELD-BOOK.

Before making the calculations it is very necessary to plot or make a plan of the field, drawn to a suitable scale, showing the measurements. Working out areas direct from the field-book without first drawing a plan of the field to scale cannot be too strongly condemned, as errors may thereby remain undetected which a scale drawing might reveal. For this purpose only a limited number of articles are required, as follows: A ruler graduated into parts of an inch—fifths, or any other suitable number desired—a set-square, and a pencil and rubber.

If a scale is not available, one can easily be made by taking a strip of cartridge-paper, drawing-paper, or even strong brown paper, about $\frac{1}{2}$ in. wide and slightly over 1 ft. in length. With the aid of a carpenter's rule carefully mark on it the inches; then divide each inch into the scale desired—that is, the number of chains to each inch.

The scale used for the purpose of the examples here shown is drawn to 5 chains to the inch (Fig. 6). The scale can be further marked, as shown, to half-chains.

Should a set-square be unobtainable, one can be readily made from a piece of strong cardboard (Fig. 7) in the same way as a right angle can be set out with a chain in the field. Take 30 links on the chain for the base, 40 links for the perpendicular, and 50 links for the hypotenuse (side opposite to the right angle). But in making a cardboard set-square the measurements would be 3 in. for the base, 4 in. for the perpendicular, and 5 in. for the hypotenuse. Care should be taken to make it exact to measurement and cut it out well.

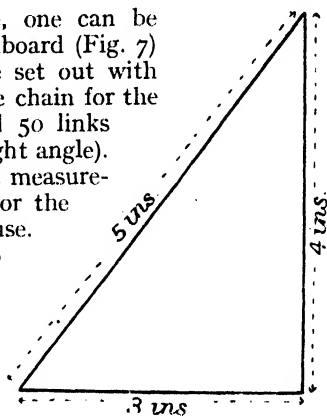


FIG. 7. SET-SQUARE.

To plot or make a plan from the field-book the procedure is as follows: Midway across a suitable-sized sheet of paper rule a line to represent the chain or base line, making its length greater than will be that of the finished plan. Mark a point A on this, near the left side, to represent where the survey begins. Then on a slip of paper add the several measurements along the base-line, shown in Fig. 5, thus:—

AH	..	..	200	
HJ	..	..	425	
			625	A to J.
JK	..	..	350	
			975	A to K.
KL	..	..	475	
			1450	A to L.
LM	..	..	300	
			1750	A to M.
MB	..	..	250	
			2000	A to B = total length of base-line.

Fix the zero end of the scale at the point A, and without removing it mark off with the point of the pencil along the base-line the points H, J, K, L, M, and B, beginning with the measurement AH 200 links, and then taking the total length from A of all the other points, as shown by the totals, up to B, 2,000 links. The perpendiculars or offsets are then drawn from these points by means of the set-square and measured to scale.

CALCULATING AREA FROM PLAN NOT GIVING MEASUREMENTS.

The area which a plan drawn to a scale represents where no measurements are given, such as in Fig. 8, may be obtained by quite a different method, as follows: Having ascertained the scale to which the plan has been drawn, get a piece of tracing-paper and draw on it a base-line longer than the length of the plan; then mark along the base-line with the point of a pencil each chain-length, and draw lines

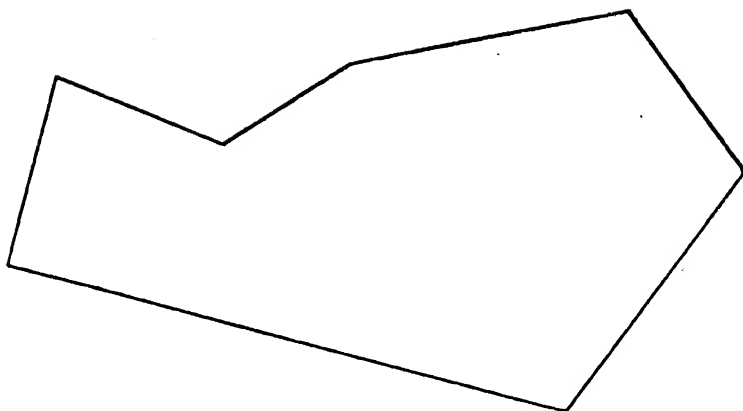


FIG. 8. PLAN NOT GIVING MEASUREMENTS.

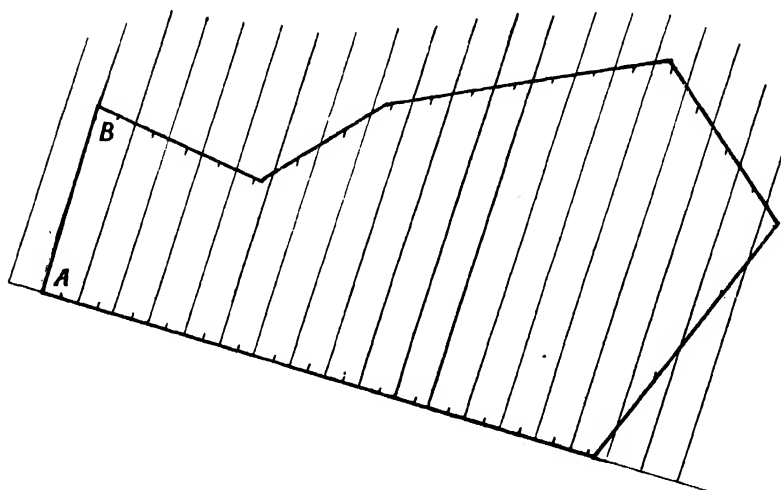


FIG. 9. METHOD OF CALCULATING AREA OF FIG. 8.

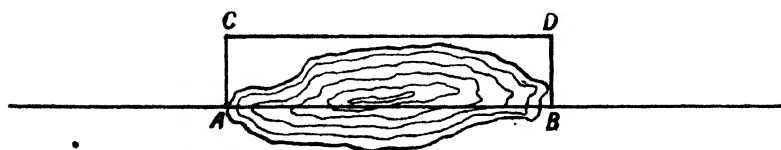


FIG. 10. OVERCOMING OBSTACLE IN MEASURING.

at right angles to the base from these points to a length sufficient to cover the plan. Place this over the plan, as shown in Fig. 9, and fix it and the plan to a drawing-board or table to prevent any movement. Then with the scale to which the plan is drawn measure the distance in length between each chain width at the points A and B, marked in Fig. 9, and so on until each division of the plan between the ruled spaces has been ascertained in the same way as AB. Each measurement in chains and links is taken down and the total added, which gives the same result as obtained in the measurements given in Fig. 5. Example:—

A to B (links) $545 + 510 + 508 + 496 + 475 + 550 + 675 + 725 + 825 + 975 + 925 + 975 + 1020 + 1060 + 1100 + 1000 + 675 + 380 + 36$: total, 13,355 links = 13.355 acres = 13 acres 1 rood 16 poles.

As each measurement taken is 100 links wide it is necessary only to divide the total by 1,000 to convert into acres, or strike off three figures from the right, which leaves the acres and decimal fraction (13.355 acres). This decimal can be converted to roods and poles by multiplying by 4 and 40 respectively, as in a previous example.

OBSTACLES.—BREADTH OF RIVER.—SETTING OUT PLOTS.

When obstacles are met in chaining, some can be overcome as shown in Fig. 10. Erect two perpendiculars AC and BD, of equal length from the obstructed line at A and B; then the measurement CD equals AB.

To find the breadth of a river or inaccessible point in a survey (Fig. 11), start from A (exactly at right angles to E) and run a perpendicular line A to B and B to C—the measurement A to B and B to C must be the same. Erect a perpendicular CD to AC, and on this perpendicular find D in a line with B and E. The distance between C and D will then equal the distance across the river, A to E.

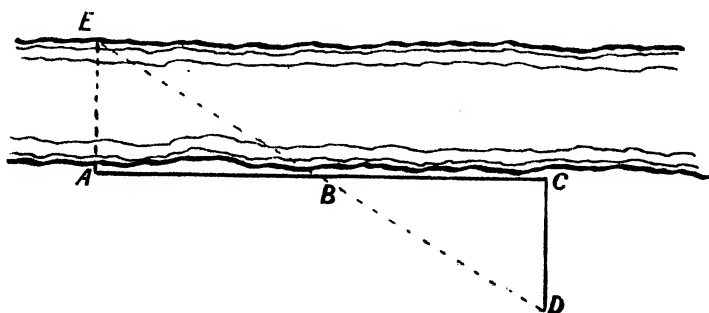


FIG. 11. FINDING THE BREADTH OF A RIVER.

If a farmer desires to set out a number of plots of a definite size in a field for any purpose—say, eight plots each one-fifth of an acre—this can be done either in links or feet, the latter being preferable for such purpose. Take the number of square feet in an acre, 43,560, and divide by 5; this will give 8,712 sq. ft. in one-fifth of an acre. Now measure the length it is desired to have the plots, and divide

the 8,712 sq. ft. by the number of feet in this measurement. The result will be the required width for each plot.

Example: Length of plot 264 ft.; then 8,712 sq. ft. in one-fifth of an acre divided by 264 equals 33 ft. as width of each plot.

TABLES.

The following tables may be found helpful for reference:—

Imperial Square or Land Measure.

144 sq. inches	..	..	..	..	=	1 sq. foot.
9 sq. feet	..	..	..	..	=	1 sq. yard.
30½ sq. yards	..	..	..	..	=	1 sq. rod, pole, or perch.
40 sq. poles (or 1,210 sq. yards)	..	..	..	..	=	1 rood.
4 roods (or 10 sq. chains, or 160 sq. poles, or 4,840 sq. yards, or 43,560 sq. feet, or 100,000 sq. links)	..	..	..	..	=	1 acre.
640 acres	..	..	..	..	=	1 sq. mile.

Gunter's Square Chain Measure.

62,726 sq. inches	..	..	..	..	=	1 sq. link.
2,295 sq. links	..	..	..	..	=	1 sq. foot.
20,661 sq. links	..	..	..	..	=	1 sq. yard.
625 sq. links	..	..	..	..	=	1 sq. pole.
10,000 sq. links	..	..	..	..	=	1 sq. chain.
25,000 sq. links (or 2.5 sq. chains)	..	..	..	..	=	1 rood.
100,000 sq. links (or 10 sq. chains)	..	..	..	..	=	1 acre.

NOTE.—Directions for measuring stacks will be given in a subsequent issue.—EDITOR.

FORTHCOMING AGRICULTURAL SHOWS.

Waitemata A. and P. Association: Waiwera, 24th January.
 Woodville A. and P. Association: Woodville, 28th January.
 Helensville A. and P. Association: Helensville, 29th January.
 Te Puke A. and P. Association: Te Puke, 5th February.
 Pahiatua A. and P. Association: Pahiatua, 6th February.
 Clevedon A. and P. Association: Clevedon, 7th February.
 Dannevirke A. and P. Association: Dannevirke, 11th and 12th February.
 Otago A. and P. Association: Dunedin, 11th and 12th February.
 Masterton A. and P. Association: Masterton, 17th and 18th February.
 Egmont A. and P. Association: Hawera, 18th and 19th February.
 Broadwood A. and P. Association: Broadwood, 26th February.
 Franklin A. and P. Society: Pukekohe, 27th and 28th February.
 Northern Wairoa A. and P. Association, Mititai: 28th February.
 Waikato Central A. Association: Cambridge, 2nd and 3rd March.
 Taranaki Metropolitan Agricultural Society: New Plymouth, 3rd and 4th March.
 North Kaipara Agricultural Association: Paparoa, 5th March.
 Te Aroha A., P., and H. Association: Te Aroha, 9th and 10th March.
 Hukerenui Agricultural Association: Towai, 11th March.
 Ashburton A. and P. Association: Ashburton, 18th March.
 Hawke's Bay A. and P. Society: Hastings, 23rd and 24th March (Autumn Show).
 Oxford A. and P. Association: Oxford, 8th April.
 Methven A. and P. Association: Methven, 15th April.

(A. and P. Association secretaries are invited to supply dates and location of their shows.)

PHASES OF FORESTRY PRACTICE.

CANTERBURY EXPERIENCES.

R. G. ROBINSON, Superintendent, Selwyn Plantation Board, Darfield.

[Paper read before the Philosophical Institute of Canterbury, September, 1919.]

PERHAPS at no previous time has the urgent need for judicious management of the Dominion's native and artificially raised forests been so imperative as at present, and with each succeeding year, as statistics reveal the rapid depletion of our timber resources, it is reasonable to anticipate much greater activity in tree-planting not only by the Government, but by local bodies and even private enterprise. The erroneous opinion that a generation must elapse before millable timber can be produced after planting is undertaken is far too general. Men even advanced in years may plant fast-growing species of the pine and gum genera with every reasonable hope to take an active part in the timber cutting and conversion operations some twenty to thirty years later.

It is not surprising, however, that in our midst a widespread belief exists, based on the experience of indifferently managed plantations, that afforestation cannot be made a payable proposition. Many instances might be quoted of magnificent returns from plantations of exotic timber designed and operated upon by practical men and grown on scientific principles, although it needs no specialist to immediately discover the defects, and in consequence financial losses, arising from artificially raised forests wherein trees of entirely different habits are wrongly used in admixture. Throughout the Dominion glaring instances of the unhappy association of trees may be seen on quite a large scale. By reason of their slower development varieties that were originally intended to form the ultimate timber crop were quickly dominated by their less valuable neighbours, thus completely altering the characteristics of the forest aimed at by the originator.

An immense amount of experimental work has been necessary in New Zealand (where the climatic and surface conditions are so extremely varied) to ascertain the respective merits of timber-trees when allocated a position perhaps entirely differing from that of their native habitat. The late Mr. T. W. Adams, of Greendale, did yeoman service in this respect, and to that gentleman arboriculturists generally are much indebted.

Contrary to opinions oft-times expressed, the very fact of a certain species of tree thriving in other parts of the world under almost corresponding climatic conditions to that of one of the New Zealand provinces does not signify that such trees will find a congenial home if introduced to this country. For instance, *Pinus sylvestris* (Scotch fir) has been planted in the colder southern districts at elevations coinciding with those where the parent trees flourish in Scotland, and with

very few exceptions a stunted growth, partially influenced by the contraction of the pine-aphis, has been the outcome.

A popular and natural prejudice against State tree-planting exists, particularly amongst lessees of Government properties that possess attractive qualities from a tree-planting aspect, and no argument advanced in support of a sound afforestation policy seems to weaken our opponents' protestations. In the British Isles, as in this Dominion, the belief is widespread that silviculture on sound commercial lines is utterly impossible. Too often can one advance with little fear of honest contradiction instances of monetary losses accruing from the raising of plantations; but in most cases the failure might be rightly attributed to (a) indiscretion in selecting varieties, (b) indiscriminate association of species irrespective of their constitution or habits, and (c) wrong spacing-distances.

The desirability of utilizing thousands of acres of waste lands within a reasonable distance from railway or water communication for afforestation purposes is apparent to those versed in the critical position of the Dominion's timber-supply, and were the various County Councils and other public bodies to initiate even inexpensive tree-planting schemes over unused lands under their control the effect would be more significant and provide greater local satisfaction than the larger State operations that are confined to widely separated localities. Indeed, under approved skilful management the Government might be prevailed upon to subsidize such undertakings, and in doing so accomplish work urgently needed without being unduly burdened with associated labour problems. The blending of results attained by pioneer tree-planters, State foresters, and present-day enthusiasts with that of Continental experts undoubtedly provides ample data to permit the prosecution of a vigorous afforestation scheme with a feeling of security. It is not my intention to here elaborate on silvicultural methods or theories in general, but rather to review lightly certain outstanding phases of practical results in forestry that to my mind appear worthy of publicity.

SEED-SELECTION.

Progressive farmers insist upon using only seeds of the highest strain for general agricultural purposes, but usually the budding or even advanced forester makes no such stipulations regarding the source of his tree-seeds, relying implicitly upon the assumed knowledge and integrity of the vendor, who in turn depends upon his collectors for the supply of only good seed. It not infrequently happens, however, that gatherers of perhaps *Pinus insignis* seed include in their collection cones from very youthful or deformed parent trees, which, unfortunately, are usually most prolific in their seed-production. On extraction, the seeds from such cones invariably present an almost entire absence of the desired uniformity in body or colour, and repeated experiments, even after dressing, prove their tendency to irregular germination excepting under the most favourable conditions, whilst the eventuating seedlings show a marked absence of the robustness generally attributable to the species. Studies of the factors influencing germination disclose the fact that seeds collected from middle-aged, well-developed specimens (of *Pinus insignis*, say, between twenty and thirty years old) produce most satisfactory results not only in the early stages of propagation, but in later

years when perhaps the uncongenial environment of the tree demands its healthy constitution.

The spring of 1918 will be well remembered as one of the worst ever experienced from a seed-germinating point of view, and the result of a small experiment conducted at Darfield may thus be regarded as of greater value in supporting my contention. From 2 lb. of freshly collected *Pinus insignis* seed taken from a quantity supplied by a well-known seed-firm some 5,050 plants were produced, whilst from a sowing under precisely similar conditions of the same quantity of seeds collected and extracted under supervision from bright well-developed cones taken from trees of good parentage some 8,220 young trees were raised. Experience has confirmed repeatedly that seeds gathered from hardy, acclimatized parent trees are more constitutionally suited for the reproduction of the type of species aimed at for commercial purposes. In propagation work a certain number of seedlings usually disclose a predisposition to weakness by the early contraction of a fungus disorder, or perhaps harbouring congregations of aphids. Other symptoms arising from faulty seed-selection are prolonged stunted growth, or the development of abnormal laterals to the detriment of the leaders. Such seedlings should not be persevered with, as in the desired plantation uniformity should be one of the first considerations with the forester.

Germinating results extending over about twelve years, in my own experience, disclose rather a lower growing percentage than that recorded by the leading Continental writers. It is, indeed, unwise to predict even the probable result from sowing until the examination of the seed-body is made. Seed-germination is influenced greatly by humidity, and it follows that with the increasing severity of the weather and surface conditions the growing percentage becomes smaller. The average germinating percentages of some of the better-known varieties from my own records may be of interest, as follows: *Pinus insignis*, 32 per cent.; *P. Laricio*, 24; *P. ponderosa*, 48; *P. muricata*, 31; *P. austriaca*, 18; *Larix Europaea*, 9; *L. leptolepis*, 7; *Picea excelsa*, 16; *Pseudo-tsuga taxifolia*, 6; *Betula alba*, 2.

Among the gums the hardier varieties, *Eucalyptus viminalis*, *E. Macarthuri*, *E. Gunnii*, and *E. acervula*, will under favourable circumstances show a return of between 17,000 and 25,000 seedlings per pound of seed, whilst from *E. regnans*, *E. fastigata*, and others only from 3,000 to 7,000 seedlings might be expected from the sowing of the same quantity.

NATURAL REGENERATION OF PINE AND GUM FORESTS.

An experiment of more than passing interest is now being conducted in the Dunsandel district, where three years ago the interior of a twenty-year-old *Pinus insignis* plantation was destroyed by fire. Unfortunately, the original mixture included *Acacia dealbata* (silver-wattle), which while under the influence of the fast-growing pines became long, drawn-up, yet inoffensive trees. The fire, not only aided seed-germination throughout, but created a perfect propagating-bed of ashes, in which wattles quickly made their appearance in thousands and grew with amazing rapidity. Almost simultaneously, however, seedling *Pinus insignis* entered the fight for domination, until the whole area relieved of the parent trees presented a veritable thicket

of wattles and pines. On the latter trees becoming well established a clear-cutting of the obnoxious wattles was embarked upon, and the desired spacing uniformity created by utilizing pine seedlings from the more densely covered spots. The partial suppression of the aggressive wattles and simultaneous nursing of the thickly studded pines have been undertaken, and, as circumstances warrant, thinning operations will be resorted to and thus induce girth-development in the remaining standard trees. Undoubtedly the natural regeneration of exotic-pine forests is a simple and comparatively inexpensive proceeding should the objectionable acacias be absent; but immediate, persistent, and well-directed measures are essential to avoid burnt-out mixed pine and wattle plantations from becoming a source of perpetual trouble.

A forestry problem the solution of which would be regarded with general approbation has long remained untouched. Throughout North Canterbury may be seen fairly extensive plantations of silver-wattle, the extreme density of which has been the outcome of prolific seeding and suckering, and although from æsthetic and shelter aspects belts of these evergreens are valuable, in many cases the area covered is quite in excess of requirements. Where the stands are not too dense trees have reached a sufficiently large size for fuel purposes, but the falling or cutting of the tree only emphasizes the trouble. My contention is that the introduction of the more assertive species of the *Eucalyptus* or *Pinus* genera would pave the way for the gradual attainment of a commercially valuable forest, and with this end in view experiments are now well under way.

The simple procedure, which is as follows, may be of interest: Where wattles are dense a clearance of about 2 ft. square is effected, and a sturdy specimen of *Pinus insignis* or a eucalypt possessing dominating characteristics (such as *E. viminalis*) is planted in the centre. Operations are carried out preferably in the winter. Experience already gained has proved that success can be accomplished only if the introduced pine or gum trees become quickly established, otherwise complete suppression by the assertive wattles will be the outcome. *Pinus insignis* is a highly light-demanding tree, and if threatened with suppression by adjacent neighbours when young it will make abnormal vertical development in its efforts to get beyond the injurious shade influence. Should an overhead canopy be too dense the boles of the insignis pine quickly attain a weak, spindly form, and the early decline of the tree is inevitable.

Many of our blue-gum (*Eucalyptus globulus*) plantations, after giving much promise, are again rapidly deteriorating in value by a recurrence of the dreaded scale (*Eriococcus coriacea*) or interference by frost-action. Indeed, it is mystifying how this comparatively tender species has withstood such low temperatures when its extreme sensitiveness to frosts is understood. The prompt action of the Department of Agriculture some years ago in importing and judiciously liberating small colonies of the ladybird beetles (*Rhizobius ventralis*) is gratefully acknowledged by many Canterbury agriculturists whose plantations, much infested with scale before the introduction of the beetles, were soon restored to a healthy state. It is very evident by the early extinction of the colonies of beetles through the absence of their natural food that the scale pest was for a time almost non-existent,

but the plantations are now threatened with a revisitation of the trouble. Under the partial shelter of unhealthy parent gum-trees seedling blue-gums are prominent, but an examination discloses congregations of scale at work along the stems and leaves, destroying the vitality of the young trees. Urgent need for the reintroduction of the ladybird beetles is essential if a repetition of the wholesale damage to timber and shelter belts is to be avoided. The interference with the growth of seedlings at the present stage of regeneration upsets, as regards *Eucalyptus globulus*, the scheme now in its infancy, although, fortunately, so far other hardier species are unaffected.

The temporary closing of plantations against stock is recommended when natural regeneration of gums is being fostered, as even if the animals in a mischievous mood do not bite the tender tree-leaders a certain amount of injury to stems and the ground-surface is caused by their movements.

ACTUAL RETURNS FROM PINUS-INSIGNIS PLANTING.

For the rapid production of light wood throughout Canterbury *Pinus insignis* (well termed the "remarkable" pine) is unsurpassed. Moreover, the value of its wood for packing-cases, interior of buildings, fuel, &c., is receiving increasing recognition, as the shortage of our native white-pine—kahikatea (*Podocarpus dacrydioides*)—and other New Zealand woods have forced users to introduce a substitute. Opinions differ regarding the relative values of kahikatea and *Pinus insignis* timbers. It is generally admitted that the exotic pine possesses many drawbacks; but with such a comparatively sudden awakening to the fact of limited future supplies the question arises whether there is any known fast-growing native or exotic tree adaptable for almost any situation that can rightly supplant the insignis pine. I, for one, know of no such tree. The seeds are easily procured, germination and subsequent propagation work are simple, and fungus and insect scourges are practically non-existent here. Frequently timber taken from a youthful *P. insignis* tree is chosen (by persons desirous of discrediting the value of the wood) for comparative purposes with that perhaps taken from a specimen of kahikatea whose age might well easily run into centuries. Rarely are the insignis pines to be seen growing under conditions suited to their proper development for milling, and it is owing to this fact that sawmillers so frequently express prejudice against the species from a commercial point of view. Wide spacing and injudicious admixture with other light-demanding trees foster the production of strong side branches, and cause the knotty boles so aggravating to the men at the saw-bench.

Thus, throughout Canterbury what appears from the margins to be uniformly planted pine plantations prove on further inspection to be ill-conditioned woods, the milling of which would probably only show a return bordering on 30,000 superficial feet per acre, instead of about double that volume if they had been originally subjected to scientific treatment. This remark is made without any desire to discredit the truly excellent pioneer tree-planting work carried out on the Plains.

In the Coalgate district the milling of a 96-acre plantation, in which such varieties as *Pseudo-tsuga taxifolia*, *Pinus austriaca*, *P.*

Laricio, *P. muricata*, *P. ponderosa*, *Picea excelsa*, English oak, ash, silver-birch, &c., were used in admixture with *Pinus insignis*, is about completed and furnishes interesting data. Planted about thirty years ago, the trees made excellent headway until the abnormal winds experienced a few years ago levelled many to the ground, thus making a clean cut-out desirable. The complete output from the 96 acres may be put down at 1,600,000 sup. ft. of sawn timber (a large proportion of which has been converted into fruit-cases, soap-boxes, and rough packing-cases), 2,250 cords of firewood, and 2,000 mine-props. Per acre, this is surely an exceedingly low yield. Included in this timber is about 4 per cent. of *Pinus Laricio*, 2 per cent. of *P. ponderosa*, 2 per cent. of *P. muricata*, and about 2 per cent. of other mixed timbers. Based upon the average current prices since operations began, the actual value on the ground of the milled timber may be estimated at £9,500, or, in round figures, £100 per acre—truly a fair return from what might be regarded as a thin and otherwise badly grown forest.

Even where specimens of *P. Laricio* and *P. ponderosa* have developed without interference, the volume of timber secured from these varieties would scarcely amount to one-third that of the *P. insignis* trees occupying similar positions, although from the slower-growing trees the superior quality of the timber is evident. As might be expected, the rapid development of the *insignis* pine influences the abnormal shrinkage and warping of its timber after cutting, and it requires no expert to understand that the stacking and seasoning of this large-celled wood are phases to which much discretion and skill must be applied. The timber of trees felled during the dormant autumn and winter periods is stronger and possesses less inclination to warp than that cut whilst the sap is active, although, on the other hand, splitting becomes an easier proposition if cutting is conducted in the summer-time.

Two years having elapsed since clearance was effected, this milled area is being restocked by "pure planting" of *Pinus insignis* at 7 ft. apart, *P. Laricio* at 5 ft. apart, and *P. ponderosa* at 6 ft. apart. Marginal lines of *Cupressus macrocarpa* are included in the scheme to partially relieve the more exposed lines of pines from the trying north-westers.

Notwithstanding higher yields of *insignis* pine on record, my experience would indicate that a return of from 60,000 to 70,000 sup. ft. per acre from a well-grown plantation (say, thirty years old) would be a reasonable anticipation. By allowing a profit of 4s. per 100 sup. ft. (a low estimate) after milling and cartage expenses the total credit balance accruing from the proposition should amount to £130 per acre.

THINNING GUM PLANTATIONS.

Realizing the urgent need for a systematic thinning of many of the Canterbury plantations of eucalypts, and being still further influenced by the increasing demand for firewood in consequence of the predicted coal-shortage, the Selwyn Plantation Board wisely decided last year to carry into effect a general scheme whereby the desired thinning and rejuvenation of the Board's gum forests could be carried out with every prospect of the undertaking proving a reasonably remunerative one, notwithstanding the unusually high current rate of wages.

Thinning activities have now been in progress for about a year, and results achieved have more than justified the confidence originally placed in the proposition. Generally the plantations consist of mixed gums in varying stages of development. Dominating specimens, up to about 6 ft. in girth breast-high, may be seen in association with the partially and completely suppressed trees, from the sapling stage upwards. The light thinning consisted of the removal of suppressed and badly grown trees, whilst where necessary a greater growing-space was provided for standards by reducing the density of the plantations throughout.

Trees were cut down to within a foot of the ground-surface, and from the stump coppicing has freely ensued. Perhaps the more important point now is the selection of the shoot to form the future bole. Where intense exposure prevails the shoot growing on the exposed side of the stump should be selected, although consideration must also be given to its sturdiness. By a well-directed blow from the back of an axe all remaining shoots should be severed. The life of the stump will be evidenced for two or more years by its persistent pollarding, notwithstanding the frequent application of the foregoing measures. Measures to promote coppicing should be conducted preferably when the sap is down or in the early spring-time. Before the termination of the growing season several shoots will issue from the stump, and the earlier the selection of an individual leader the better. With each succeeding operation, however, the root-system of the stump becomes more disorganized, until the weakened coppicing entirely ceases.

Briefly, where circumstances demand, in dense gum plantations, after the trees have attained a reasonable height, the object should be to (a) effect uniformity and provide a space sufficient for moderate girth-expansion; (b) foster regeneration by the raising of seedlings over the more isolated spaces; and (c) carefully avoid interference with the required standards. Thus a two-storied forest will be the outcome, enabling systematic cutting to be arranged at periods suitable for the disposal of the timber. The age of the trees now being operated upon ranges from twenty to thirty years, and after removing between six and twelve cords of firewood, or an equivalent, per acre, the standing timber may be reasonably assessed at 28,000 sup. ft. per acre.

Little publicity has in the past been given to reliable data concerning the progress of eucalypts under forest conditions. Sample plots are being prepared throughout the Canterbury Province to determine the precise volume of standing timber, and by periodical measurements interesting and reliable information will be gathered, and thus more accurately disclose the possibilities of hardwood production under various conditions.

PLANTING-DISTANCES AND SHELTER-BELTS.

Insufficient recognition of the intense importance of allocating a correct spacing-distance when planting trees is almost universal. Irrespective of the existing humidity, or surface being operated upon, a standard spacing between each tree is generally regarded as satisfactory by planters, even when afforesting on a comparatively large scale. The following conclusions, however, will indicate the results of opinions formed after lengthy experience over varying surfaces and altitudes:—

(a.) That generally the faster the development of any variety of tree the greater may be the spacing-distance allotted.



ONE OF THE SELWYN BOARD'S GUM PLANTATIONS (30 YEARS OLD) BEFORE THINNING.



THE SAME PLANTATION AFTER THINNING.

(b.) That in sheltered valleys where humidity is more intense and the surface more fertile there is no occasion to plant so densely as on the hillsides; and generally the more exposed and otherwise unfavourable are the planting-conditions the greater the necessity for closer planting.

(c.) That with the increasing tendency of varieties (such as *Cupressus macrocarpa*) to produce strong laterals the need for a lesser growing-space becomes correspondingly more pronounced.

Thus in operating with *Pinus insignis* or gums on the Canterbury Plains, 7 ft. apart pure planting is an excellent spacing-distance between the trees if the object is to produce millable boles without having recourse to heavy thinning-work. Should, however, a humid valley possessing a surface and substratum congenial to the growth of pines be afforested, the spacing might be increased with perfect safety to 8 ft. between each tree, although with increasing elevation and exposure and tendency for the trees to develop protective laterals greater density (say, 6 ft. to 7 ft. apart) is required to bring about the desired result.

In raising shelter-belts, however, the production and retention of the side branches are points of paramount importance, and the crowding of trees so necessary for clean bole-development must be strictly avoided. Therefore, should the conditions warrant a spacing-distance of 7 ft. for timber purposes, from 8 ft. to 9 ft. apart would be sufficiently close if several lines for a shelter-belt are needed. Where only one line is possible and the characteristic of the tree is of little moment one might incline to the closer spacing with feelings of security. The following abbreviated table showing the suggested economic planting-distances for the average Canterbury land will not be out of place here, although variations after the manner advocated in the preceding remarks are worthy of consideration before a decision is arrived at on this important point by the tree-planter:—

				Distance apart (in Feet).	
				For Timber.	For Shelter.
<i>Pinus insignis</i>	..	..	..	7	8 to 9
<i>Pinus ponderosa</i>	..	..	..	5 to 6	7
<i>Pinus Laricio</i>	..	..	..	5	6
<i>Pinus muricata</i>	..	..	..	..	8
Eucalypts	..	..	..	7	8 to 9
<i>Cupressus macrocarpa</i>	..	..	..	5	8 to 9
<i>Pseudo-tsuga taxifolia</i>	..	..	..	5 to 6	8
<i>Larix leptolepis</i>	..	..	..	5	..

Apart from the more pleasing results attained by judicious spacing, the tremendous importance of this phase from an economic standpoint is obvious. At 6 ft. apart some 1,210 trees are required to plant an acre of land, whilst at 8 ft. apart only 680 trees are needed. Oft-times farmers, in their ambition to simultaneously produce branchless boles and shelter, will plant trees of the *Pinus insignis* type at 4 ft. apart, anticipating the early removal of alternate trees. Long rows will certainly be the outcome, but the provision for shelter will be defeated, inasmuch as the protective branches will be absent through overcrowding; again, plantations thus formed rarely fail to collapse when subjected to winds of more than ordinary severity. Should trees of the

scaffolding-pole type be aimed at, dense pure planting (at, say, 5 ft. to 6 ft. apart) is recommended, complete clearance to be effected as occasion demands. Marginal lines of a deeper-rooting tree of the *Populus*, *Pinus ponderosa*, or *Cupressus macrocarpa* types create a support for the plantation body, and in addition tend to promote humidity and accelerate height-progress.

A somewhat effective though hideous pioneer shelter-fringe is created by topping the exterior line or two of pines. Should the severing of the leader immediately above the whorl be skilfully undertaken before trees have exceeded the desired height little disfigurement is the outcome, although perhaps a repetition of the operation would probably be inevitable. The popular wholesale amputation of tops and branches should be discouraged by those keen on preserving a naturally artistic effect.

Tall-growing pines should not be planted within at least half a chain of the road fence-line, although should one so desire and the conditions lend themselves to the project the intervening space might with much advantage be converted into an attractive shrubbery. The common error made by many worthy pioneers of planting up to within a few feet of the roadway and divisional boundary-fences with *Pinus insignis*, irrespective of the ultimate certain obstruction to thoroughfares and adjoining properties, is, unfortunately, still being practised. By using such trees, however, as *Cupressus Lawsoniana*, *Wellingtonia gigantea*, the spruces, &c., as an ornamental and shelter barrier the deleterious effect is not so far-reaching as when the fast-growing pines have been chosen for the purpose.

The sacrifice of belts of splendidly grown trees fringing roadways over which the Lake Coleridge electric power is transmitted to Christchurch has caused some consternation amongst owners and the travelling public generally, who realize the probability of losing still more of the valuable wayside shelter-belts should any further reticulation project cause the transmission-wires to be further directed along other courses. So with the expansion of the electric-power service and the evident necessity of disfiguring arterial roads with transmission-poles too much stress cannot be laid upon the risk associated with road-line improvements. To my mind, an immediate survey and public definition of the main routes over which the power will be carried should be made by the authorities, so that intending planters may with confidence beautify their holdings without the fear of having to destroy perhaps magnificent road-avenues of trees just as their maximum value from æsthetic and shelter aspects is reached. That the bark blown from gum-trees (the worst offenders) adjacent to the high-power wires frequently causes a short circuit has been proven beyond a doubt; but we have yet to learn what distance the transmission-wires must be from the offending trees to be beyond the influence of the loose bark during the prevalence of a strong nor'-wester.

TREES RECOMMENDED FOR COMMERCIAL PLANTING IN CANTERBURY.

Much diversity of opinion exists regarding the selection of trees for general afforestation work in Canterbury, and even those well versed in the subject, after long continuous experiments supported by observations whilst abroad, are not at all unanimous on the point. Land

that will simply grow trees may prove absolutely incapable of yielding a crop sufficiently well grown to make the undertaking financially sound. Then, again, the prospective planter usually chooses his poor-quality land, but it not infrequently happens that he gives little consideration to the under-stratum after feeling satisfied that the surface conditions are favourable for tree-life. True, a fertile surface will cause speedy headway during the early life of the tree, but as the root-system descends into perhaps an objectionable pan or waterlogged stratum it is not difficult to understand in that case the sudden change in the health of the tree. It is unreasonable to expect better-class timber to be grown on intensely porous land which on examination discloses only a few inches of medium surface soil covering a deep stratum of shingle.

Abundant evidence has been produced substantiating the contention that slowly but regularly grown wood possesses a better texture than that raised with greater speed, although over dredged tailings, shingle-pits, and such surfaces the tendency for the timber to become "pumped" is decidedly acute.

Suitable planting-areas that may be regarded at present as inaccessible will probably with the further progress of motor traffic in the heavier transportation work be linked up with railway centres or junctions at no distant date. This fact is worthy of consideration by those more isolated landholders who now hesitate to plant for fear of inability to market the produce.

A few brief remarks on trees of proved commercial value may be given a place here :—

Softwoods.

Notwithstanding the liability of the tree to become uprooted during the prevalence of high winds, particularly when no provision has been made for protecting the exposed margins, I am convinced that *Pinus insignis* should be given first place among the softwoods. The high esteem in which the New-Zealand-grown insignis pine is held may be gleaned from the remarks made to me in 1914 by two eminent Continental foresters, Dr. Henry and Mr. Elwes, who affirm that our *Pinus insignis* is assuming characteristics almost unknown in the species in its natural home (California), plainly indicating that our conditions are ideal for the propagation of the tree. It not only grows strongly in its youth, but continues to prosper even on the lightest lands. The full uses to which the timber can be put have yet to be discovered ; but for cases, joinery, interior building-construction, and fuel purposes it surely meets many requirements.

Pinus ponderosa (yellow pine) and *Pinus Laricio* (Corsican pine) are two exceedingly hardy varieties. They are both more wind-firm than the preceding species, and the timber is of better texture. Both, however, require a longer rotation, although when allocated congenial situations a vertical development of between 15 in. and 18 in. annually may be expected.

Pseudo-tsuga taxifolia (Douglas fir, or "Oregon pine") : The value of the timber of this shade-bearing American tree is universally known. Perhaps the susceptibility of the leaders to injury from high winds is its greatest drawback. The tree is otherwise hardy, but, like other

members of the *Abies* family, it prefers rich, loamy, cool surfaces. For restocking a partially cut-out forest where abnormal shade prevails the Douglas fir is excellent. Two other varieties that may be recommended for this purpose are *Thuja plicata* (Pacific red cedar) and *Abies Meretsiana* (black hemlock). Possessing also highly ornamental characteristics, the Douglas fir should at least have a junior place where the conditions lend themselves to the inclusion of graceful evergreens.

Hardwoods.

Of the tried hardwoods such gums as *Eucalyptus viminalis* (mannagum), *E. Macarthuri* (Paddy River box), *E. amygdalina* (peppermint-gum), *E. Gunnii* (cider-gum), *E. coriacea* (white-gum), and *E. gigantea* (swamp-gum) have shown their partiality for the less trying positions on the Canterbury Plains and resisted even the most severe frosts. *Eucalyptus globulus* (blue-gum) and *E. obliqua* (stringy-bark) may also be seen thriving, but these species are much more sensitive to climatic changes, whilst the former variety readily contracts scale discomforts even when neighbouring specimens of other gums are perfectly free from the pest. *E. obliqua* seems to be most satisfactorily grown in admixture with other more hardy species.

Medium Woods.

Cupressus macrocarpa (Monterey cypress): This tree should not be despised, particularly by the farmer who needs durable fencing-material. Planted closely—say, 5 ft. to 6 ft. apart—on soil of medium fertility the trees should attain a sufficiently large size for general farm use in about twenty to twenty-five years.

Larix leptolepis (Japanese larch): On the higher elevations in cool sheltered situations this tree will grow very quickly. The mature wood is extremely valuable for all general purposes, whilst saplings (cut at the right time and partially seasoned) are easily converted into fencing-stakes. The autumnal tints of the tree, blended with some of the darker-foliaged varieties in the immediate vicinity, add considerably to the attractiveness of a holding. Larches should not be planted on the Plains, where they fall an easy prey to the needle-shedding trouble.

At intervals throughout a plantation a few lines of fire-resisting trees, such as varieties of *Populus* or *Betula alba*, afford greater security to the forest, and form a starting-point for back-firing should a conflagration arise.

BRIEF CULTURAL NOTES.

Although no attempt will be made here to detail tree-propagation methods or planting-systems a few points of importance on associated matter may aid the rising arboriculturist to greater success. The more unfavourable the planting-conditions the more imperative is the need for operating with sturdy and otherwise well-balanced young trees. In cultivated, partially sheltered ground a fair measure of success may be expected by using yearling plants that have not undergone transplantation, but which if allocated less congenial situations would utterly fail. Perhaps the tendency for tree-planters to secure big trees irre-

spective of their root-system accounts for much of the unprofitable work conspicuous in windy localities.

The wrenching of pines and other evergreens in nurseries, to induce fibrous root-development and harden off the plant-stem, should be insisted upon by purchasers. Many of our progressive nurserymen strictly adhere to this desirable practice, although there are others who maintain that the little benefit arising from the root-cutting operation scarcely justifies its adoption. To my mind, the success in planting out is greatly emphasized by a rapid transition of the tree from the nursery line to its permanent situation, as the physiological disturbance created by a disorganized root-system is then less sustained. A very large percentage of failures may be traced to lengthy transportation of trees, prolonged confinement of trees in bundles or cases, and faulty heeling-in prior to permanent planting.

Another important point inseparable from successful planting is the effective firming of the tree by foot-pressure. It not infrequently happens that the subsequent swaying movement of the young plant causes vacuum from the stem to the roots, but if attended to in time no ill effects follow beyond a temporary lull in sap-activity. This wind-shaking trouble may be partially avoided by planting the tree against the back of the prepared pit on the side farthest from the prevailing wind. Contrary to the popular belief, tree-roots readily strike out against the more solid side, and naturally have a more tenacious hold than those issuing through the pulverized soil.

The oft-repeated question, "What is the best time to plant?" requires the support of surface and other details before an intelligent reply can be given. Generally, early spring planting (say, towards the end of August) is attended with most success, but, of course, this is conditional on the trees being allowed to remain in the nursery lines through the winter. Pines in bundles are very subject to heating if permitted to remain for any length of time in trenches. In spring planting, trees seem to receive less check and become more quickly established than those put out in the autumn or winter, there to remain dormant for months, in many cases alluring rabbits and becoming loosened by winds and lifted by frost-action. It is wise, though, to also duly consider the likelihood of early rains after planting before a decision is arrived at.

Paspalum Seed.—Great care should be taken in buying *paspalum* seed at the present time owing to the very inferior seed on the market. New-Zealand-grown seed of the 1919 season should on no account be sown unless its germination capacity has been first ascertained. Australian seed seems fairly satisfactory.—*Biologist*.

Limestone Samples.—Samples analysed recently by the Chemistry Section gave the following content of carbonate of lime: Chancet, Ward, 73 and 85 per cent.; Kaipara, 92.5, 86.5, and 87.5 per cent.; Napier, 92 per cent.

WORK FOR THE COMING MONTH.

THE ORCHARD.

AFTER an enforced spell of four or five years there appears, at the time of writing, every prospect of shipping-space being available for the export of fruit this season. This will mark a very important stage in the development of the fruit industry in the Dominion. Owing to the ships being diverted through the Panama Canal there seems little possibility of the South American market being available, but no doubt the North American and English markets will afford a good outlet for our fruit. Orchardists must rise to the occasion and establish a good name for New Zealand fruits. If they aim at producing the best, New Zealand fruit will soon become as well known as its butter and cheese. To bring this about and ensure success all connected with the industry must do their part well.

Much depends on the orchardist—on the manner and way he handles the fruit. Too much care cannot be exercised in the orchard. Pick only those fruits which are ready and will pass the colour requirements. Sever carefully from the tree, and, if possible, leave the stem intact. Apples with the skin torn at the stem are of no use for export. The necessity of careful handling cannot be too much emphasized. This was very forcibly demonstrated in the cool-storage experiments conducted last season. Any handling-bruise will show up by the time the fruit reaches its destination overseas. Once fruit is picked, keep it in the shade and away from the direct rays of the sun. Speed it away to the packing-shed, and arrange to have a full and competent staff of graders and packers to handle it expeditiously. There should be no delay anywhere; the interval between picking and packing should be the shortest. Once packed, place the fruit promptly in the cool store to await shipment, even if this period is only a few days.

The grader has a most important function to perform, as it is his duty to maintain the standards defined for export, and any fruit that is in the least doubtful should be rejected without hesitation. The packer should also do his share of the work faithfully. It is only by the combined efforts of all those concerned in the production of the fruit and preparing it for market that a good name for New Zealand can be established on the overseas markets.

The general work for the month is dealt with in the district notes which follow.

—Gordon Esam, Acting Assistant Director of the Horticulture Division.

AUCKLAND.

The harvesting of stone-fruits is now in full swing. Careful attention must be given to this important part of the year's operations, but growers should endeavour to avoid neglecting other seasonable operations. Mid-season varieties of pip-fruits will soon require to be gathered also. The mistake is too often made of picking fruit at the wrong time, sometimes too soon, before it is matured, and at others at the overripe stage. The correct time will be indicated very largely

by the vigour of the trees and class of land. Growers should give due consideration to this factor and use their discretion, as much loss is incurred annually in this respect, particularly by stone-fruit growers. Many instances came under my notice last season where the despatch of stone-fruits, and in some cases apples and pears, fully ripe, was much delayed. This upsets prices considerably, and with stone-fruits it is conducive to development of brown-rot.

The present is the most suitable period for carrying out budding operations.

As soon as the last jam strawberries are gathered, spray plants throughout with bordeaux, 4-4-40, for leaf-spot. As a preventive measure against infection of stone-fruits by brown-rot during the ripening-period a spray of commercial lime-sulphur, 1-125, or self-boiled lime-sulphur, 8-8-50, is recommended. Continue the regular three-weekly application of arsenate of lead for control of codlin-moth, leaf-roller caterpillar, and leech on pip-fruits until the time of harvesting arrives. Spray English and Japanese plums with arsenate of lead, 1 lb. (paste) to 50 gallons, for control of cherry-slug. In cases where citrus trees are affected with scale or thrip, and where the young growth has sufficiently hardened to permit of it, spraying should be undertaken with red oil, 1-40.

Spraying summary. - Peach, nectarine, and plum: Commercial lime-sulphur, 1-125, or self-boiled, 8-8-50, when fruit reaches ripening-stage.

Pear, apple, and quince: Commercial lime-sulphur (33° test), 1-100, in conjunction with arsenate-of-lead paste $1\frac{1}{2}$ lb., or powder $\frac{3}{4}$ lb., to 50 gallons water, every twenty-one days.

Lemon and orange: Bordeaux, 4-4-40, when petals have fallen from main crop of blossoms; red-oil emulsion, 1-40, when spring growth has hardened (after bordeaux).

Strawberry: Bordeaux, 1-4-40, when fruit is all off.

—J. W. Collard, Orchard Instructor, Auckland.

HAWKE'S BAY.

A number of varieties will be ready to pick during February. A good deal of fruit becomes useless each year through being removed from the tree too soon. Immature fruits shrink badly and become quite as useless as fruits which are allowed to become overripe before picking. Pickers will do well to remember that all the fruit on one tree cannot possibly be ready to pick at one time, and to get the best marketing results selection should be practised and each tree picked over as occasion demands. When the fruits are removed from the tree they should be shaded as much as possible from direct sunlight, and handled without delay.

Codlin-moth and leaf-roller: Repeat applications of arsenate of lead. Many growers withhold the arsenate, as no moth is evident, only to find that the broods which hatch out at this time nullify all the good spraying-work of the past. It is not uncommon to find young grubs hatch in case-fruit where spraying has been suspended too early. At this season of the year arsenate may be applied with advantage up to within a few days of picking.

Black-spot: Keep a good lookout for live fungus, and apply lime-sulphur, 1-100, or bordeaux, 3-4-40.

Woolly aphid: Blackleaf 40, 1-800, has proved the most satisfactory summer control. This preparation may be used in combination with arsenate of lead or lime-sulphur, or both, but if used alone 3 lb. of soap per 100 gallons should be added.

Red mite: As indicated in last month's notes, regular application of lime-sulphur will be necessary at this period to control active mites.

Leech or pear-slug: This pest will be well to the fore throughout the month, and arsenate of lead, 1 lb. paste or 10 oz. powder to 50 gallons, should be applied as a control.

Powdery mildew: Spray infected trees with lime-sulphur, 1-100, or atomic sulphur, 10 lb. to 100 gallons, every three weeks.

Plum-rust: Spray with bordeaux, 3-4-50, or lime-sulphur, 1-120, paying particular attention to trees which were infected last season.

—W. M. Rice, Orchard Instructor, Hastings.

NELSON.

The main apple-harvest will soon commence, and preparations for handling it should be completed. Packing-sheds and stores will need to be put in order. The latter will be all the better if fumigated with burning sulphur. The crop, it is to be remembered, is bulky and perishable. Study to reduce the handling as much as possible, and have the conditions in the air-cooled store right—i.e., dark

and cool, and ventilated at night and in cold weather. Arrange to deal promptly with cull and waste fruit. If there is no other use for it neighbouring farmers will be glad of it for their pigs.

It is very possible that part of the crop will be exported to North America, where the port inspection is exceedingly strict, as some growers know to their cost. As it is no consolation to know that codlin-moth, leaf-roller, or black-spot developed on the voyage, it is desirable to spray the crop two or three weeks before picking, in order to avoid the disappointment and loss of having it condemned. Mid-season and late stone-fruit, too, will require a similar attention as a preventive of brown-rot and other troubles. In this case spray the trees a month before picking with lime-sulphur, 1-125, or self-boiled lime-sulphur, 8-8-50.

In young orchard sections the cultivation will need to be maintained and a careful watch kept to see that blight does not interfere with the completion of the season's wood. Spray at once should the need arise. Leaf-roller, leech, or aphids are the most likely troubles. The autumn is probably the very best time for carrying out a thorough spraying campaign and ridding the trees of their unwelcome attentions.

While lime may be applied to the orchard requiring it almost at any time, the end of February is probably the most suitable. Manures and cover-crops have comparatively little effect without lime. Lime is constantly demonstrating itself to be the best corrective of the mechanical and chemical condition of Nelson soils. Apply it with a distributor over the whole area of the orchard.

The present season of the year is right for "budding" most fruit-trees.

--William C. Hyde, Orchard Instructor, Nelson.

Cultivation should be thoroughly attended to during February, as after that the busy period of harvesting the main crops will not allow much time for cultural operations. Summer pruning may be carried out, as recommended in last month's notes.

Keep the arsenate-of-lead spray on apples and pears for late broods of codlin-moth and leaf-roller caterpillar. Fruit for storage should show plenty of traces of arsenate-of-lead spray to prevent the ravages of leaf-rollers, which so often do considerable damage to fruit in storage. Remember there is no market for moth-infected fruit, not even in the factories, therefore immediately an infected fruit is noticed it should be picked and destroyed, otherwise it will only be robbing the tree of nutriment that should be going to clean fruit, besides spreading infection by rearing the larvæ. Apply a late spraying of lime-sulphur, 1-120, to prevent later infections of black-spot. This should also apply to fruit for storage. Last season's experience of the development of black-spot in stored fruit would then be obviated to a great extent. The lime-sulphur spray will also be found beneficial for control of red mite. When applying spraying-mixtures do not neglect woolly aphids wherever it appears. Wash the aphides right out with high pressure and give them no chance to congregate in colonies.

Fruit for export should be carefully selected and only the very best sent forward. Avoid packing immature or overripe fruits, choose the happy medium and make it the best quality. Make certain that no diseased fruit enters the cases. See to it that the work of preparing the fruit for market is carried out by qualified graders and packers. Keep a uniform standard grade of quality, and have the fruit properly sized. Used the diagonal pocket system of packing, and have no "rattle" in finished cases. --W. T. Goodwin, Orchard Instructor, Motueka.

CANTERBURY.

Growers will be kept busy during February picking and marketing their crops. Sufficient has already been said in these notes with regard to the marketing, although it cannot be too strongly emphasized that the better the general get-up the better will be the price. Attention should be given to the actual picking of the fruit, remembering that fruit picked immature usually shrivels before being placed on the market, while overripe fruit soon decays. The correct time to pick the different varieties can only be learned in the orchard. Seeds and colour help to determine whether fruit is mature or not. There should be at least two pickings from every tree, as all fruits do not mature at the same time. When picking, care should be taken not to destroy the fruit-spur, or the next season's crop will be lost. Pip-fruits should be picked with the stems intact, thus preventing any fungus or rot disease from entering the fruit at this point.

Spraying should be continued throughout the month, following the directions given in previous notes. One more spraying with arsenate of lead for codlin-moth on the later varieties should be sufficient; another application of Black-leaf 40 if woolly aphid is on the increase; and should there be a late development of black-spot on pears bordeaux, 3-4-40, should be applied.

During the month attention can be given to any summer pruning that is necessary, eliminating all unnecessary growth and treating laterals for the formation of fruit-buds for the next season. Budding can be done with success during the early part of the month. Full instructions are given in Bulletin 81 issued by the Department.

—George Stratford, Orchard Instructor, Christchurch.

OTAGO.

Growers will now be hard at work harvesting the stone-fruit crop, and other operations in the orchard are liable to be neglected. This is very often the case with necessary spraying, and considerable loss is often occasioned by omitting a further spray of arsenate of lead for codlin-moth and leaf-roller, also cherry and pear leech.

Woolly aphid still needs looking after with Blackleaf 40 on the lines indicated in last month's notes. Black-spot made great headway during early February last year and caused severe losses; growers should therefore be on guard this season and keep a careful watch for this, spraying with lime-sulphur, 1-120. Present indications are that the infection is much earlier this season. The same measure should be taken in regard to mildew.

Peach-rust was also bad last season in many orchards, especially on the Lady Palmerston variety. Spray these with lime-sulphur, 1-140, to help keep the trouble in check. Atomic sulphur can also be used for this disease, at a strength of 1-10. Where the growth is heavy and the centres of the trees full of young shoots it will be found advantageous to remove the latter, so as to let in the light and air and give the fruit a better chance to ripen and colour. The fruit-buds for next year will have a better chance to ripen up also. Thinning of apples can still be undertaken where necessary to relieve overcrowded or stunted trees. Cull out the diseased and deformed fruits during this operation.

—J. H. Thorp, Orchard Instructor, Dunedin.

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

WITH the rapid growth now being made by the young stock, and little culling having yet been carried out, the accommodation on the plants of many breeders is fast becoming overtaxed. In order to lessen the risk of overcrowding and its evil effects on the birds no time should be lost in disposing of all cull cockerels that have attained a marketable age. This will not only add to the comfort of the remaining stock on the plant, but will also effect a considerable saving in the food-bill. Of course, it is from the early-hatched cockerels that selections should be made for future breeding purposes. They should be carefully gone through, and none but the strongest and best types should be retained for the renewal of stock. In this connection it is always a good plan to select more males than those actually required, for some of the birds may have to be rejected at a later date. It often happens that a male bird when young looks very promising, only to prove disappointing when a more developed stage is reached. On no account should a late-hatched cockerel, or one that comes to maturity at an extremely early age, be selected. These seldom or never grow to a desired size, and therefore prove next to useless when the mating-time comes round. As a general rule it is the big-framed slow-maturing male bird with active habits that makes the best sire.

The feeding of the stock of the various ages on the plant at the present time requires considerable judgment on the part of the poultry-keeper. A common mistake made in this direction is to provide a similar ration to all birds alike. The quality of the food should be in accordance with the age of the birds and the object aimed at. For instance, if the adult birds are to give their maximum egg-yield a fair proportion of animal food is an essential. In the case of the growing pullet, however, meat and other similar forcing foods should be sparingly supplied. In fact, if there is any sign of the birds coming to prematurity these materials should be eliminated from the ration, or the birds are apt to commence laying before a desired size and a proper healthy development has been attained. It is not generally known that when a pullet commences to lay she ceases to grow. Therefore, instead of hastening production with the pullet intended for winter laying, she should be kept steadily growing, and everything done to promote health and constitutional vigour. Having this in view, a good range under the most natural conditions possible, shelter from cold winds and shade from sun, together with roomy quarters and strict attention to cleanliness, are factors that must not be overlooked.

FEATHER-PULLING.

Several inquiries have lately reached me asking for a cure for feather-pulling. This is one of the troubles affecting poultry for which there is no actual cure, prevention being the only real means of dealing with it. The first step is to find the cause and remove it at the earliest possible moment. It is usually the result of keeping the birds in too confined quarters, or allowing them to become badly infested with vermin. The parasite usually responsible for fowls acquiring the habit of feather-pulling cannot be seen by the naked eye. It is at the root of the feather and causes severe irritation to the bird. It is in order to get rid of this irritation that a bird will allow its feathers to be plucked out by its mates. The only remedy is to give the birds more range and make sure that there is no vermin present. The first step in the latter direction is to keep the house in a thoroughly clean state and give periodical sprayings with a strong disinfectant. Further, see to it that the birds are provided with a good dust-bath, as this is an essential if they are to rid themselves of the annoying parasites. When it is not convenient to increase the range for the birds, and they are being kept under confined conditions, everything should be done to keep them well occupied by way of exercise. Ample litter should be provided in which the hard grains should be scattered. This will keep the birds busy in searching for the food, which will go a long way towards making them forget the feather-pulling vice.

LEG-WEAKNESS.

Keep a watchful eye on the forward chickens for leg-weakness. This is usually the result of an oversupply of forcing-food or the lack of exercising-space. When once a bird becomes badly affected with this trouble it should be killed, as it is next to useless trying to cure it. Prevention is the one and only safe course in dealing with this trouble, and the only reliable method is to eliminate rich foods, such as meat, milk, &c., from the ration, and provide ample exercise.

INQUIRIES.

I am continually receiving letters asking for advice on the treatment of stock affected with certain troubles arising generally from improper management, but seldom do the writers supply the information necessary for me to understand the cause, much less to suggest a remedy. Inquirers cannot be too explicit in describing any trouble they desire advice upon. Full details of the symptoms observed, together with the system of feeding and the general conditions under which the birds have been kept, would prove most helpful. In the case of trouble being met in the hatching and rearing department, full particulars should be furnished as to whether artificial or natural methods are being adopted. This, with particulars as to the make of incubator used, and whether heated or cool brooders are being worked, would greatly assist me towards arriving at an opinion as to the cause of the trouble.

THE APIARY.

G. V. WESTBROOKE, Apiary Instructor.

EXTRACTING OPERATIONS.

At this time of the year the operation of extracting the honey should keep the successful apiarist fully occupied. Where a good "flow" of nectar is on it may be necessary to keep the extractor constantly going in order to provide storage room for the bees and to prevent them blocking the brood-combs with honey. This "high-pressure" extracting may be avoided where the beekeeper has a plentiful supply of drawn-out combs and spare supers to place on the hives. It is estimated that by giving the bees completed combs the yield of honey will be double that obtained if they are supplied with sheets of foundation only. The time occupied in drawing these out into comb during a short flow may result in a serious loss to the beekeeper, hence the necessity of taking great care of the combs.

In large apiaries it is usual to have two persons to do the work of taking the honey for extracting. One manipulates the smoker and bee-brush, while the other takes out the frames of honey. The latter operator first gives the frame a sharp shake to remove the bulk of the bees and then hands it to the other person, who brushes off the remaining bees and then places it in the carrier or super on the barrow. When robber-bees are about it is advisable to have a cloth damped with a weak solution of carbolic to cover the frames as they are removed. Only ripe honey should be taken from the hive. The beginner should therefore take care to see that more than three parts of the combs are sealed over by the bees. They will not as a rule seal over the cells until it is ripe.

In place of the bee-brush many prefer to use a small branch of manuka or other soft-leaved shrub. The advantage of this is that it can be burnt after use, in case there is any danger of the honey containing spores of foul-brood. This precaution, however, should not be necessary, as no careful beekeeper would allow his bees to go

so long before treating the disease, but would have eliminated it before the extracting season.

Where queen-excluders have not been used it will be necessary to see that there is no brood in the combs removed. If frames containing small patches are found they should be placed at the sides of the super; when the brood hatches out the cells will be filled with honey, and they can then be extracted. If frames containing eggs and larvæ are found in the super they should be placed with the queen in the bottom box, and if possible a queen-excluder put between, so as to prevent her again ascending to the supers. Any capped brood may be left in the supers.

When the honey is removed it should be immediately taken to the extracting-room, which should be bee-proof. As the honey is more easily extracted while warm the work of uncapping and extracting should not be delayed. In large apiaries the steam-heated uncapping-knife is now in general use, but where this is not available it will be found best to keep the knife hot by means of a vessel containing hot water which is placed over a small lamp. It is an advantage to use two knives, so that while one is in use the other is getting hot for the next comb. The uncapping should be done over an uncapping-can, or over a cappings-melter. The can should have a strainer about three parts of the way down. On top of the can is a bar of wood from which projects a short spike; the frame rests on this, so that it may be placed at any angle to suit the convenience of the worker. To allow the cappings to drop into the can the frame should be tilted slightly forward. The cappings may be left in the can for a day or two to allow them to drain; they can then be pressed to secure the remaining honey, and melted up.

The beginner usually commences with a two-comb extractor. A reversible one is much easier to work than a fixed type, as it saves lifting out the frame after one side has been extracted. Experience will soon teach the best speed for turning. It is important to see that the extractor is placed level on a fairly solid foundation. If a platform is used it must be made very strong, as the vibration caused by the revolving weight will be very severe on it. The wet combs after extracting should not be taken out of the room until evening, when they may be placed on the hives again. This precaution will probably prevent robbing starting.

VITICULTURE.

S. F. ANDERSON, Vine and Wine Instructor.

THE COOL VINEHOUSE.

FROM this time on, so long as there is any growth at all, the vine should have perfect freedom. It now has three to five months to build up and store for next season's production of fruit those essential qualities that restore the fertility of the plant. The roots, wood, and buds can now get that full benefit of the strong foliage that has been kept back for the benefit of the fruit. This applies particularly

to the growth made at the top of the house. It matters not how tangled a mass it appears, it is all helping to strengthen the vine. I have often gone into vinehouses after the fruit has been gathered and found a great part of the foliage cut away with the mistaken idea that it was not required, or for the purpose of getting rid of or controlling mealy bug, mildew, &c. If mealy bug is present, now is the time to cyanide, for no injury to the vine is likely to be done. If it is mildew, give it the treatment recommended for that trouble, but do not cut out the foliage. Another factor in the encouragement of this strong autumn growth is the reciprocal action between the foliage and roots. As the autumn advances the sap elaborated by free growth descends and adds to the extremities of the roots that nourishment helpful to future production. Some growers have remarked that cutting back the vine at this stage plumps up the buds at the base of the laterals that have borne fruit. They certainly do fill out, but they cannot store up that energy for future effort so well as when the foliage is left on to ripen off in a natural manner.

OUTDOOR TABLE GRAPES: THE ALBANY SURPRISE VARIETY.

The Albany Surprise, owing to its immunity from mildew, and its large bunches of acceptable fruit, has largely replaced the European varieties that have hitherto been grown for the table. Wherever a vine will grow outdoor this vigorous variety appears the most reliable. The general public are fast becoming reconciled to its peculiar flavour. It should not, however, be put on the market till perfectly ripe, as its acidity is very high when not fully matured. Being a very strong grower and long-jointed, it requires plenty of room and long pruning, and therefore cannot permanently be grown within the same limits as the European vines. Heavy crops of well-ripened fruit are being grown in the ordinary way on espalier fences. The habit of the variety demands different treatment, however, and a few years' close pruning will cause the vines to go back in vigour. Growing on sloping banks and covering places such as low rocks, keeping the rods about 1 ft. off the ground by stakes, the fruit ripens well. For general planting, from 10 ft. to 20 ft. apart each way is close enough. The vines should then be trained over the ground, as described and illustrated in the *Journal* for March, 1917.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

THE planting of broccoli, cabbages, cauliflower, savoys, brussels sprouts, and kales should be completed at once in all but the warmest situations. If planting extends far into February failure is probable, as in most places there will be too short a period of warm weather to promote development. Cauliflowers of the Autumn Giant type are an important crop. If good plants are put out the heads should be

ready about Easter-time, coming in before the earliest broccoli and filling a gap consequent on the finish of peas and beans.

Final plantings of celery should be made at once. The plants should be well supplied with water until they get into good growth, when a dressing of nitrate of soda should be given. It would be practically useless to give nitrate of soda while heavy watering is being done, as, being very soluble, it would mostly be washed away. Leeks should be planted at once; if left much later they will not succeed. For winter use of spinach sow the prickly-seeded variety about mid-February. This is a crop worth growing well, being practically immune from disease or insect troubles. Sow in rows 12 in. apart, and thin to 9 in. or 10 in. apart. A suitable fertilizer is superphosphate, four parts, and sulphate of potash, one part, giving 4 oz. per square yard; a dressing of nitrate of soda, $\frac{3}{4}$ oz. per square yard, to be given after thinning. Other things that may be sown include French beans, turnips, carrots, lettuce, raddish, silver-beet, and onions for salading.

Tomatoes: Attend carefully to the suppression of side growth. Spray about every fortnight with 4-4-40 bordeaux mixture. Soda may be used in place of lime, in which case use 5 lb. instead of 4 lb. of lime.

Cucumbers under Glass.

The culture of cucumbers in frames is a comparatively easy proposition; almost any person with intelligence can manage it with some degree of success. Their culture in glasshouses, where they must be trained up the rafters, is quite a different matter. This is not an appropriate time to deal with the whole subject, but recent observations show that a few remarks may be of use to those who with little or no instruction are attempting to so grow them and often failing. It may be said at once that this is one of the "fine arts" in horticulture, and complete and unfailing success depends on the grower having a thorough understanding as to what the plants require and how to handle them. I have found it very hard to get beginners to believe that the fruit will grow without being fertilized, yet this is one of the most essential points. Although the fruits do not hang long enough for the seeds to ripen, the growing of seeds at all is exhausting to the plant. Further, when a fruit bears seed it is a bad shape, the lower end being invariably swollen. Symmetrically-shaped fruits are obtainable only by not allowing them to bear seeds. The fruits grow as well without seeds as with them, and as the process of bearing seedless fruits is not exhausting, except in so far as the roots eventually impoverish the soil, a set of plants can be kept in full bearing from early spring to late autumn, when the weather gets too cold. In the process the haulm is renewed by cutting back leaders and securing new, and by constant pinching and regulating the secondary leaders. From the very beginning all the male blossoms should be pinched out as soon as they form. People to whom it seems strange that a fruit can grow without being fertilized will perhaps be reconciled to so curious a fact when it is pointed out that bananas rarely contain seeds, and are not fertilized. All the figs that are grown, with the exception of the Smyrna fig, are from unfertilized female blossoms. There are also seedless oranges, seedless pears, and at least one variety of grape that is seedless.

Cultivation and Fertilizing.

A few weeks of dry weather is usual at this season, and good cultivation is necessary to conserve soil-moisture. The hoe or cultivator should be in frequent use to keep down all weed-growth, and maintain a loose surface to act as a dust mulch to prevent the escape of moisture.

Growth should be encouraged by giving a light dressing of nitrate of soda, a salt that is very potent in its effect, particularly where little or no animal manure has been used. The usual fertilizers—superphosphate, &c.—are not sufficient in the culture of green vegetables when stable or farmyard manure is wanting; there is still something lacking. In such cases nitrate of soda acts like magic. A teaspoonful scratched into the soil around a young plant that is just starting growth after being transplanted will soon promote strong growth. Five or six weeks later, when the plants have made some headway, a further dressing of the nitrate should be given by broadcasting, allowing about $\frac{3}{4}$ oz. per square yard.

A useful liquid manure for green crops generally is superphosphate four parts, nitrate of soda two parts, and sulphate of potash one part. Use 1 oz. to each gallon of water, and give sufficient to moisten the soil presumed to be occupied by roots. Note that this mixture should not be applied more than twice or thrice during the growing-period of any crops.

SMALL FRUITS.

Strawberries: The fruit season being past, the opportunity offers for breaking up the soil between the rows, an operation that should not be neglected. The soil between the plants in the rows is also liable to become hard on the surface; it should be loosened, or, if that is not practicable, some loose soil drawn up from between the rows. This refers, of course, to beds that are to be kept for another year. The production of runners should be restricted. It is best to set aside certain rows for propagating new plants, so that the major part of the plantation may be kept in a good state of cultivation, which has an important bearing on the maintenance of the plants in a thrifty state.

Red currants: As all the fruit is borne on spurs on wood that is more than one year old the object should be to encourage their formation. Branches must not be crowded, as light and air are necessary to make fruitful spurs, which will be formed on every part of the branches. If a bush becomes crowded the lower parts of the branches will become barren. Strong side shoots that have been made this season should be cut down to 6 in.; this will encourage the formation of new spurs at the base of the shoots. Be sure not to cut them shorter, for if that were done the lower buds would probably break into wood-growth and the purpose be defeated. Where borers are troublesome the bushes may be sprayed with lime-sulphur, 1-100. This is not a complete check, but it is of considerable value.

Black currants: These bushes do not require summer pruning.

Gooseberries: Bushes that are in a crowded state may be profitably relieved of some of the branches at this time. The effect will be to relieve the bushes of an unnecessary burden in carrying useless growth through the dry season. It will also admit light, and materially strengthen buds on the inner parts of the branches. Spray the bushes with 4-4-40 bordeaux as a check to leaf-spot.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

PASTURE FOR GERALDINE DISTRICT.

W. M. HARRIS, Pleasant Valley, Geraldine :—

Please advise me as to the best mixture of grasses, giving quantities of each, to sow on land intended for dairying. The land is fairly heavy on a stiff clay bottom, and is at present in wheat. I intended sowing it down with rape and grass next November. Would this do well after wheat?

The Biologist :—

The following mixture is recommended for permanent pasture on your country : Perennial rye-grass, 15 lb.; cocksfoot, 15 lb.; crested dogtail, 4 lb.; timothy, 4 lb.; red clover, 3 lb.; white clover, 2 lb. The practice of sowing down permanent pastures with rape, &c., is not to be recommended. The addition of rape means early feeding off, which is detrimental to the young pasture plants, particularly so in a dry season. It would be preferable to sow your rape in November alone, and in the autumn to lightly work the rape-stubble and sow down the above specified permanent pasture.

FORAGE CROPS FOR SHEEP.

J. C. NEILL, Weraroa :—

Please inform me what would be the most profitable feed to sow broadcast during January or February on good fallow land in this district, crop to be fed off on ground during July and August by (a) lambing-ewes, (b) fattening wethers. It is intended to use the land next season for mangolds and swedes.

The Agriculturist :—

To sow in January or February for lambing-ewes or wethers there is no crop more suitable than turnips, preferably Imperial Green Globe, Romney Marsh, and Centenary Green Top, in the order named. Cereals sown at the time mentioned would require feeding off, say, in April, and would consequently lose vitality and not produce much feed at the time required. Another plant which will yield a big bulk of feed is Thousand-headed kale. This would be more suitable for wethers than for ewes. With both this and turnips dry feed should be given the stock. Ewes should be kept off turnips on frosty nights. Sow at the rate of 1½ lb. to 2 lb. per acre of turnips or kale, mixed with 2 cwt. of superphosphate, per acre. Broadcast sowing can be done by hand or drill, taking off coulters and tubes and allowing seed to fall from openings of box. If the roots or kale are not grown the next best thing would be oats sown in April.

STOCK AND TUTU.

W. E., Puketitiri, Napier :—

As there is a good deal of ground tutu on portions of my property I should be glad if you could advise me as to the safest time to put stock unused to the weed on this land.

The Live-stock Division :—

At no time is it absolutely safe to permit stock to eat this shrub. Tutu is most dangerous to stock when eaten on an empty stomach or immediately after they have been taken off roots, also when the young shoots of the shrub are beginning to spring. It is also liable to be harmful in a dry season, with scarcity of feed, if stock are transferred from clean ground on to tutu-infested paddocks.

FAILURE TO REAR CATS.

"CATS," Aria :—

I have tried unsuccessfully for the last three years to rear cats. They grow and look fat until about three months old, when they start to vomit and die in about twenty-four hours. I have opened the last four and find in each case that the gut is full of hard worms about 4 in. long with broad-arrow heads. Will you kindly advise treatment and feeding? We give them all the new milk they can drink.

The Live-stock Division :—

The probability is that the heavy infestation by the worms you describe (*Ascanis mystax*) is the cause of death. We would advise you to administer once monthly $\frac{1}{4}$ grain santonin and $\frac{1}{4}$ grain calomel, either as a powder or pill, for three alternate days—all food being withheld for at least twelve hours previously. Twice this dose may be given to adult cats. The only precaution to be taken as regards feeding is to see that the food is cooked and feeding-utensils kept clean.

GROWING SILVER-BEET FOR POULTRY.

T. H. RUTHERFURD, Masterton :—

I shall be glad of advice regarding the growing of silver-beet as green feed for poultry. When should it be sown, and for how many years will it continue to yield? I have had some in now for two years, but have obtained only very light cuttings, as the plants always run to seed.

The Horticulture Division :—

For practical purposes silver-beet should be planted every year. The plants always run to seed the second season, and the leaves are then very small. For supplying poultry-feed the seed should be sown in spring in fairly good soil. Thin the plants to at least 10 in. apart. By sowing at once you should get a good supply of leaves during winter. A fresh lot should be sown in spring, as those sown now will probably go to seed next season in a shorter time than if they were sown in spring.

DEALING WITH HORSE BOT-FLY.

"SUBSCRIBER," Henderson :—

Could you suggest a simple method of keeping the bot-fly off and out of horses?

The Live-stock Division :—

Where an animal is in constant work this can be accomplished by the attendant scraping or singeing the eggs off as soon as they are deposited on the hair. The method, however, is not applicable when horses are running in the pasture. In such cases a mixture of creosote and oil can be used—2 drams of creosote to a pint of oil. This should be lightly smeared all over the body. To be effective it should be applied every few days; and it is the usual experience that most horse-owners would rather run the risk of having their animals affected with bots than be put to the trouble of applying the treatment.

CREAM-SEPARATION.

"CREAM," Kaitoke :—

Please tell me why 5 gallons of night's milk yields $5\frac{1}{2}$ pints of cream, while little more than 3 pints of cream is obtained from 6 gallons of morning milk.

The Dairy Division :—

Providing the milk is in normal condition there should be no material difference in the proportionate amount of cream separated from a given amount of milk, irrespective of whether the milk be from the morning or evening supply. In all probability the reasons for the variation in the quantity mentioned are due to the speed of the separator and the quantity of milk which is allowed to pass through the machine. The separator should be run at the speed specified by the

makers, and the quantity of milk should be in accordance with its capacity. If, for instance, the speed of the separator is not up to the maximum the volume of cream will be increased, and there will also be some loss of fat in the skim-milk. If too large a quantity is allowed to flow through the machine the same thing will apply. On the other hand, the volume of cream will be much less if the flow of milk is reduced below the capacity of the machine. It is imperative that both the speed of the separator and the quantity of milk passing through it be regular, when there should be no practical difference in the volume of cream in proportion to the quantity of milk handled.

SELF-SUCKING HEIFER.

“SETTLER,” Ruawhata :—

Will you please advise what is best to do with a heifer that sucks herself? She is a three-year-old grade Jersey, lately calved.

The Live-stock Division :—

The appliances used to prevent this form of vice are many and varied. Some are effective, but most of them are undesirable to put into operation, as they prevent the animal from having the free use of the head to lick itself or drive away flies from the fore quarters. They also prevent freedom in feeding, and are a continual source of annoyance not only to the animal, but also to the dairyman. It would be far better to allow this heifer to rear her own calf, and perhaps also another one, or get rid of her as fat. Should you, however, decide to try some device, methods observed in use include the following: A strongly made leather halter with a few spikes about an inch long attached to the noseband, which is supposed to prevent her getting freely at the teats without hurting the udder. Or a leather headstall and bodyband, with a pole the thickness of a broom-handle attached between, this preventing the head from reaching the udder.

LAWSONIANA SHELTER-HEDGE.

E. T. WISE, Te Poi, Waikato :—

I should like your advice regarding the best trees to grow for shelter-hedges in this district, and the month in which they should be planted. Trees which will grow quickly and which cattle will not eat are required. Could you also tell me the best and cheapest way to procure the plants?

The Horticulture Division :—

Cupressus Lawsoniana has proved to be pre-eminently the best plant for shelter-hedges in the Waikato. The plants are raised from seeds, which may be sown in boxes early in March. The young seedlings should be ready for transplanting into nursery rows the following spring, and for planting out a year later. It may be preferable to obtain the trees from a nurseryman, saving more than a year and obviating risk from failure to raise the trees satisfactorily. They may be planted in May, or in the spring about August. Plant 30 in. apart.

HORSE WITH SHOULDER TROUBLE.

C. MULLIGAN, Kapuka, Southland :—

Kindly advise me what treatment to give a horse with his shoulder out.

The Live-stock Division :—

The probability is that your horse is suffering from what is known as shoulder-slip, or supra-scapular paralysis, a totally different condition from displacement of the joint. The horse may or may not get better from this condition. The only treatment likely to be of any use is the application of stimulating liniments to the shoulder-muscles. Usually horses affected with this complaint can work without any inconvenience. If the shoulder is actually out, the horse should be cast with the affected shoulder uppermost, and a rope be applied to the affected limb, which should then be stretched as far as possible while pressure is applied to the affected joint. Unless a dislocation is attended to within a few days, replacement is difficult, if not impossible.

CARBON BISULPHIDE FOR RABBIT-POISONING.

For some time past the Department has been endeavouring to arrange for cheaper supplies of carbon bisulphide for use in coping with the rabbit pest, and the following summary of the information already obtained concerning the prospects of importation and local manufacture is published for general information. The subject is still being followed closely, and there will probably be more to report at an early date.

IMPORTATION OF SUPPLIES.

In March, 1917, it was suggested by one of the Department's officers that the Government should import a quantity of carbon bisulphide from England, and distribute it to the farmers at prices sufficient to cover the expenditure involved. Owing to the serious advance in the market price of carbon bisulphide in New Zealand its use as a rabbit-poison was at this time practically discontinued. The High Commissioner, London, was therefore requested by cable to obtain quotations for 5 tons, in 5-gallon drums, at per gallon, f.o.b., British port. The quotation duly received was £320, f.o.b., London. This, amounting to £64 per ton, was considered too high a price, and the Department did not accept the offer.

The subject was again brought up in December, 1918, when the Fields Inspector, Queenstown, reported that some of the farmers in the Arrowtown district had been using carbon bisulphide for rabbit-poisoning, and that in consequence their farms were exceptionally clean. Owing, however, to the very high price of the material some of the farmers could not afford to purchase it. The price of the article was then said to be £160 per ton, and the Inspector recommended that the Department should import stocks of this very effective supplement to the other various modes of destroying rabbits. The question was then submitted to the Department's Chemist (Mr. B. C. Aston), who reported that whereas the pre-war price of carbon bisulphide in wholesale quantities would be about 2½d. per pound in Germany and other manufacturing countries, the price ruling then (February, 1919) for the limited supplies available in New Zealand worked out at approximately 1s. per pound. The Chemist therefore suggested that inquiries should be made by cable in Australia for commercial carbon bisulphide, and that the shipping charges should be definitely ascertained. With this data—initial cost and shipping charges—it would be possible to say whether the local price was fair or excessive.

A quotation and the particulars of freight were duly received, and, reporting on the figures then available, the Chemist stated, "Comparing the estimate of the Dunedin firm with that of the Melbourne quotation, I find that the cost of the former would be 1s. 0½d. per pound, f.o.r., Dunedin, and the latter 8½d. per pound, c.f., New Zealand ports. This would apparently amount to some £42 per ton saving, but this is not taking into consideration insurance, and cost of landing and storage in New Zealand." Subsequent information disclosed that the local rate had advanced again, and it was decided to import 2 tons of carbon bisulphide from Australia. This was duly distributed through the Fields Inspectors, a consignment going to the North Island and another consignment to the South.

In the meantime a communication was despatched to San Francisco to ascertain the price ruling there. The quotations received from the United States were slightly lower than the Melbourne prices, but the Director of the Live-stock Division pointed out that there was the question of longer storage to be taken into consideration with a liquid of so volatile a nature as carbon bisulphide, and that in the absence of any previous experience in this respect he did not feel disposed to recommend the experiment of importing from San Francisco.

In July, 1919, a further supply of 7 tons was purchased at Melbourne at the approximate cost of £68 per ton landed in New Zealand.

With regard to the shipping question, the Union Steamship Company stated, "Our rule in connection with this article is that it must not be carried on any passenger-ships. On cargo-ships the freight from Melbourne and Sydney, without transhipment, is 70s. per 40 cubic feet or 20 cwt.—whichever is the greater."

PROPOSED MANUFACTURE OF CARBON BISULPHIDE IN NEW ZEALAND.

Owing to the considerable difficulties and expense connected with the importation of carbon bisulphide, it has been suggested that the material should be manufactured in New Zealand. This proposal was referred to the Chemist, who submitted the following report, dated 18th July, 1919:—

"As the constituents from which carbon bisulphide is made are sulphur, charcoal, and coke or coal there is no doubt that it could be manufactured in the Dominion. There might be some difficulty in obtaining an officer with the experience necessary to run such a works, but there are full details of the methods used in the past, and those now used in American works by electrically heating carbon and sulphur (Taylor's patent) can be found in Wellington libraries. The question to consider is what amount of carbon bisulphide can be used in New Zealand, and whether it will pay to erect a plant for producing this amount rather than to import it from Australia.

"In the *Journal of the Franklin Institute*, February, 1908, p. 141, a full account is given of Taylor's patent. With an expenditure of 100 h.p. 5,000 lb. of carbon bisulphide can be produced in twenty-four hours, but production by stronger alternating currents could be raised to 10,000 lb. in twenty-four hours. The furnace is 16 ft. deep by 41 ft. high; there are forty electrodes arranged crosswise, and two dynamos of 330 kilowatts working at 30-60 volts will produce 14,000 lb. to 15,000 lb. in twenty-four hours; with increase of current the same apparatus would produce 25,000 lb. in twenty-four hours. Each electrode consists of twenty-five carbons, 4 in. by 4 in. by 48 in., so that each electrode has a section of 20 sq. in. (*sic*). The electrodes last a year. These are placed at the foot of a vertical shaft furnace filled with small pieces of coal and charcoal. The replacing of the charcoal takes place by a side canal at the side of the furnace. Melted sulphur flows in below the electrodes, and then is vaporized through the hot carbon."

Mr. L. Birks, Chief Electrical Engineer, Public Works Department, was asked for his opinion on the proposal to manufacture the material locally, and the following is the substance of the report which he kindly supplied after consideration of the literature and information placed before him by Mr. Aston:—

"The manufacture of carbon bisulphide appears, from the data you submit, to be suitable for hydro-electric development on a small scale, if the market is available for the output. Taking the output given by Taylor (p. 144) of 5,000 lb. per day of twenty-four hours, with 100 h.p.—say, 11 tons per week or 350 tons per year of thirty-two weeks, leaving twenty weeks for overhaul and repair of the furnace—the cost would apparently be roughly as follows:—

	Per Year.	Per Ton.	Per Pound.
Raw material at, say, £8 per ton delivered, and, say, 80 per cent. efficiency of conversion ..	£ 3,500	£ 10.0	d. 1.07
Electricity, 85 k.w. at £10 per kilowatt-year ..	850	2.4	0.26
Labour—say, twelve men at £220 per year each	2,640	7.6	0.81
Electrodes, say	100	0.3	0.03
Packing, say	1,500	4.3	0.5
Management, repairs, and contingencies ..	1,500	4.3	0.5
Total working-expenses	10,090	28.9	3.17
Interest—say, £12,000 at 6 per cent. ..	720	2.1	0.22
Depreciation—say, £10,500 at 10 per cent. ..	1,050	3.0	0.32
	11,860	34.0	3.71

"Assuming the whole 350 tons per year can be sold, this should be saleable at 4d. per pound, or 36s. per hundredweight, *f.o.r.*, at the works. This figure should leave a substantial margin of saving to cover any slight deficiency in the demand. But if only one-half the above amount can be sold the price would probably have to be increased substantially to cover costs, unless the business can be run as a seasonal business, when the freezing-works are closed down, enabling spare power and spare labour to be utilized to advantage during the off season—say, August to December. It might actually be run in conjunction with a large freezing-works or fellmongery, in which case most of the charges would be substantially less for a reduced season of working than if run as an independent business—particularly the marketing charges, which are not included in the above figures."

It will be noted that Mr. Birks has calculated the expense and equipment for an output of 350 tons per annum, but this is considerably more than could be utilized in New Zealand at the present time. The Department considers that the most it could now use for rabbit-poisoning in the Dominion would be 30 tons a year. Inquiries are, therefore, being instituted as to the possibility of establishing a smaller manufacturing plant than one turning out 350 tons per annum.

In the meantime, however, the foregoing information may be of interest not only to farmers, but also to manufacturers who are desirous of obtaining a cheap fat and rubber solvent. If a constant demand for carbon bisulphide could be guaranteed the local manufacture of the material by the electrical method of heating might be started.

EXPORT OF APPLES TO HONOLULU.

THE embargo preventing Australasian fruit entering the Territory of Hawaii has been recently removed so far as apples from New Zealand are concerned. The following is the proclamation to that effect issued by the Governor of the territory, dated 31st October, last :—

"Section 1. For the purpose of preventing the introduction into the Territory of Hawaii of fruit-flies and insects, their eggs, larvæ, or pupæ, and all diseases of plants, fruits, or other vegetation of value, all persons, companies, and corporations are hereby prohibited from introducing, importing, or bringing, in baggage or otherwise, into the Territory of Hawaii, or into any of its ports for the purpose of disembarkation into the said territory, any fresh fruit from East or West Indies, Asia, Australasia, Oceania, Malaysia, Mexico, Central and South America : Provided, however, that fresh apples may be imported into the Territory of Hawaii direct from New Zealand in cold-storage only, if they are free from insect pests and plant-diseases, and are accompanied by a Government certificate declaring that the apples have been grown in New Zealand and are shipped free from insect pests and plant-diseases, and are also accompanied by a Government certificate declaring that they have not and will not come in contact with Australian-grown fruit on the voyage to the Territory of Hawaii."

The Director of the Horticulture Division (Mr. T. W. Kirk) has been in communication with the executive officer of the Hawaii Board of Agriculture Commissioners, who supplied him with the foregoing information and also the following facts, which will be useful to exporters :—

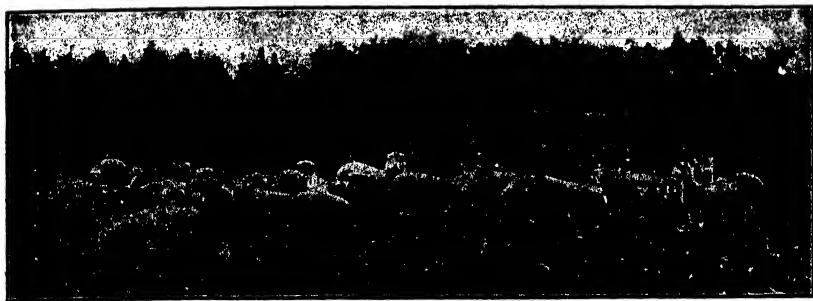
"The three leading firms in Honolulu which could handle New Zealand apples are : Theo. H. Davies and Co. (Limited), American Factors (Limited), and Fred. L. Waldron (Limited). The representative of Davies and Co. informs me that he would be willing to handle New Zealand apples on consignment, taking 10 per cent. on the gross sale price in Honolulu. The present wholesale price for Californian apples in Honolulu is 3 dollars per box. All of the firms listed above are reliable, and handle practically all of the wholesale business and importation in this territory. The certificates which are required to accompany apple shipments should be sent to Mr. E. M. Ehrhorn, Chief Plant Inspector, P.O. Box 207, Honolulu."

Intending exporters should consult the Fruit Inspectors at Auckland, Wellington, Christchurch, or Dunedin before shipment.

Certificates in Pruning and Spraying.—In the list published in the November, 1919, *Journal* the name of Mr. F. W. Cone, of 50 Langdon's Road, Papanui, Christchurch, is given in the second class. Mr. Cone gained a first-class certificate last year.

Utility Poultry for Breeding Purposes.—The price-list for birds from the Department's poultry-stations has been revised as follows for all breeds : Cockerels and drakes, 15s. and 20s. each, according to selection ; pullets and ducks, 15s. each ; coop included in all cases.

Control of Rabbit Nuisance.—The Maungakawa Rabbit District, in the Wai-kato, has been formally constituted.



The New Zealand Journal of Agriculture.

VOL. XX.—NO. 2.

WELLINGTON, 20TH FEBRUARY, 1920.

TESTING OF PUREBRED DAIRY COWS.

REVIEW OF THE C.O.R. SYSTEM IN 1919.

W. M. SINGLETON, Assistant Director of the Dairy Division.

THE evolution of the dairy cow in New Zealand affords an interesting subject for study. In the earliest days of our cattle industry the requirement was mainly for beef, and beef cattle were imported, the Shorthorn breed predominating. These developed to a very considerable extent throughout the country. With the advent of dairying the Shorthorn cattle were used as a foundation in the majority of herds kept for dairy purposes. Crosses of Ayrshire were first made with the Shorthorn, while during more recent years Jersey and Friesian grades have been coming very much to the front.

A review of statistics shows that of late years in our principal dairying districts the dual-purpose cow has been giving way to the special-purpose dairy breeds. From 1908 to 1918 the number of purebred Shorthorn bulls in Taranaki decreased 90 per cent., whereas the number of purebred Jersey, Friesian, and Ayrshire bulls increased 60 per cent. Taking the different land districts, the enumeration of 1918-19 shows that, for every 100 Shorthorn females two years of age and over, the corresponding figures for Jerseys, Friesians, and Ayrshires

were: Auckland, 33; Otago and Southland, 31; Wellington, 64; and Taranaki, 134. When we consider that the Shorthorns are practically the foundation of our average dairy herds the trend of breeding of dairy stock in the various districts is apparent. The 1919-20 figures will doubtless present the position in a light more favourable to the special-purpose dairy breeds, as it is well known that the Auckland Province has lately imported large numbers of grade Jerseys from Taranaki. This tendency of the cattle industry towards special-purpose dairy breeds is an indication of the healthy condition of the dairy industry. Dairy-farmers are in ever-increasing numbers realizing that only efficient dairy cows are compatible with high-priced land. The increase in land-values and smaller holdings is exerting a considerable influence in popularizing those special-purpose breeds that will produce dairy-products at the lowest cost.

Another evidence of the progress of the industry is to be found in the increased volume of cow-testing that is being carried on by dairy farmers and breeders. Never before in the history of dairying in New Zealand has the tendency in this direction been so marked. The progress made in association testing of grade cattle is a very encouraging feature. While this phase of testing enables the herd-owner to cull out uneconomical producers, its effect in saving the best producers, and more especially in inducing the owner to breed better, is the more important. Ultimately our dairy herds can only be intrinsically improved by better breeding. When a cow-testing association member studies the butterfat production of his individual cows, and is thereby induced to purchase a butterfat-record purebred bull, the testing has accomplished a great work on his behalf, and indirectly is a means of increasing the wealth of the Dominion.

The number of breeders entering cows for certificate-of-record test has continued to evidence an ever-widening interest in the work. During the present season testing officers are paying monthly visits to some 202 breeders as compared with 155 last year, an increase of about one-third.

EXPORT OF PUREBRED DAIRY CATTLE.

If further evidence of the progress of the dairy industry as affected by testing be required it will be found in the export of purebred stock. Our records of purebred dairy cows has attracted the attention of breeders in Australia and in some of the Pacific islands. Some sixty-one head of New Zealand Friesians, valued for Customs purposes at £3,045, were shipped last year, and others were purchased for later shipment. While some of these animals were of such superior quality that we can ill afford to lose them, their work for their new owners should be so pleasing as to further popularize New Zealand strains abroad, and be conducive to further profitable business.

NINE-HUNDRED-POUND BUTTERFAT RECORDS.

At the beginning of the year under review the Register of Merit had one cow in the 900 lb. butterfat class. This was Westmere Princess Pietertje, the leader of the junior four-year-old class for Friesians. During 1919 Burkeyje Sylvia Posch qualified for the 900 lb. class, and became leader of the mature class for her breed.

Sultan's Daisy very worthily represents the Jerseys in the list of animals attaining this 900 lb. butterfat distinction. Her record was produced with twice-a-day milking, and constitutes a New Zealand if not a world's record under such conditions.

Mutual Pearl of Rock (Friesians) was on test during the year. She completed her milking-period with a production entitling her to a place with the three cows referred to, but as she qualifies on subsequent calving during 1920 she is to be credited to that year.

Special comment has been made in previous issues of the *Journal* on the animals which have received certificates for production in the 900 lb. class, and interested readers will be familiar with the details.

PROGRESS AS INDICATED BY CERTIFICATES ISSUED.

The total number of certificates issued shows a satisfactory increase over that for the previous year. The number of ordinary certificates issued—259—is sixty-three above that of the preceding year. This increase amounts to 32 per cent., and is in harmony with the percentage of increase of testing breeders already referred to. It is apparent that the number of certificates received per testing breeder maintains considerable uniformity. While it would be less expensive to carry on the testing-system were the increase found in the number of cows tested per breeder, the existing conditions widen the influence exerted by the testing and doubtless make it a more potent factor for dairy-herd improvement.

Certificates have now been granted on the production of 1,260 registered cows. As the number increases, the amount of information the records will afford to breeders in particular and to dairymen in general will be more valuable to them in formulating breeding plans and "grading up" the average dairy cow. The following table indicates the general position:—

Breed.	1913.	1914.		1915.		1916.		1917.		1918.		1919.	
		Ordinary.	Repeat.	Ordinary.	Repeat.	Ordinary.	Repeat.	Ordinary.	Repeat.	Ordinary.	Repeat.	Ordinary.	Repeat.
Jersey ..	67	104	14	91	4	94	11	94	13	113	8	150	14
Friesian ..	48	67	11	62	9	44	5	62	14	57	14	54	7
Ayrshire ..	..	17	1	12	1	9	..	4	3	4	..	2	..
Milking Short-horn ..	..	..	..	2	..	7	..	21	..	22	..	53	3
Totals ..	115	188	26	167	14	154	16	181	30	196	22	259	21

FRIESIANS.

The black-and-whites have not been so long established in New Zealand as have the other dairy breeds. With the building-up of any breed the principal difficulty is in supplying new breeders with purebred foundation females of the best ancestry and quality. New Zealand is not in a position to import from the United States or Holland, owing to adverse import regulations. Breeders, however, have been strengthening their herds by breeding from the strains

already represented in our purebred herds prior to the war. A number of strains have been coming to the fore through high production. It is believed we have some of the best Friesians existing, and that intelligent breeding during the next decade should place the New Zealand black-and-whites "in the limelight" to an even greater extent than is the case to-day.

Class-leaders.

During the year two of the 1918 class-leaders have been superseded. In the junior three-year-olds Ethel of Friesland Park, with a C.O.R. for 17,663·2 lb. milk, containing 638·85 lb. butterfat, has been replaced by Rosevale Holland Queen, owned and tested by H. North and Sons, Omimi. She has qualified for a C.O.R. on a production of 657·39 lb. butterfat, thus raising the class leadership by 19·46 lb.

Holland Queen, who was class-leader for a number of years, has been replaced for the leadership of the mature class by the Canadian-bred cow, Burkeyje Sylvia Posch. The latter cow also replaces Westmere Princess Pietertje as New Zealand champion milk- and butterfat-producer.

With these exceptions the 1918 class-leaders have retained their places. The 1919 leaders constitute a most creditable list, two being in the 900 lb. butterfat class, two in the 800 lb. class, one in the 700 lb. class, and the leaders of the junior two-year-olds and junior three-year olds in the 600 lb. class.

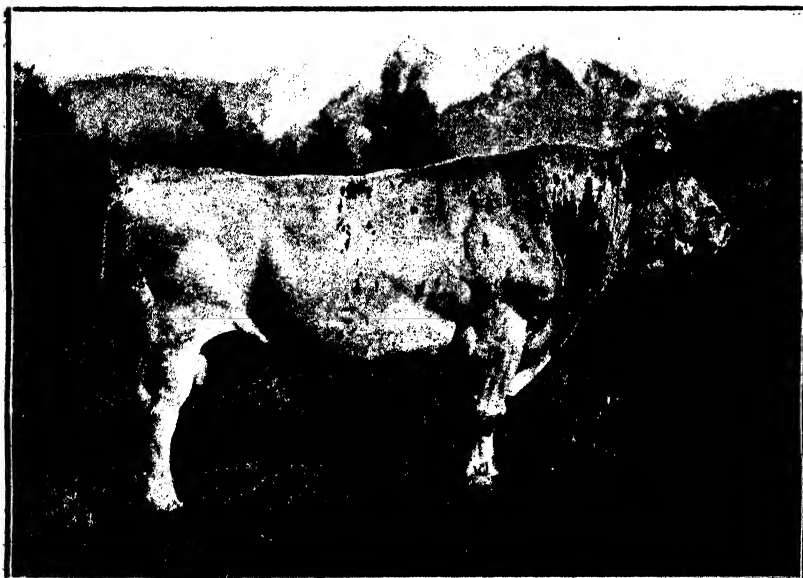
Following is a complete list of the class-leaders for 1919 :—

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
<i>Junior Two-year-old.</i> Princess Pietertje de Kol	R. Melvin, jun., Masterton	Y. dys. 2 102	lb. 250·7	365	15,577·80	626·82
<i>Senior Two-year-old.</i> Netherland Princess IV	J. Donald, Westmere	2 341	274·6	365	19,621·60	805·77
<i>Junior Three-year-old.</i> Rosevale Holland Queen	H. North and Sons, Omimi	3 165	293·5	365	16,016·30	657·39
<i>Senior Three-year-old.</i> Manor Beets Daughter II of Ashlynn	C. A. Hopping, Palmerston North	3 296	306·6	365	18,733·90	863·51
<i>Junior Four-year-old.</i> Westmere Princess Pietertje	J. Donald, Westmere	4 156	329·1	365	24,199·00	939·78
<i>Senior Four-year-old.</i> Woodcrest Johanna Tehee	J. Donald, Westmere	4 325	346·0	365	21,483·10	754·96
<i>Mature.</i> Burkeyje Sylvia Posch	H. North and Sons, Omimi	6 129	350·0	365	26,226·00	983·20



BURKEYJE SYLVIA POSCH.

Leader of the Friesian mature class, and champion milk and butterfat cow of New Zealand.



INKA SYLVIA BEETS POSCH.

Sire of Burkeyje Sylvia Posch. Sire also of May Echo Sylvia and other famous Canadian dairy-cattle. At time of death owned by the Agassiz Experimental Farm, British Columbia.

Class-averages.

The number of females qualifying for certificates shows a falling-off of about 14 per cent. This is a feature which will doubtless claim the serious attention of the Friesian Association. To an outsider it would appear that there is room for a constructive forward movement. That the Friesian has proved one of the foremost dairy breeds in New Zealand, as well as elsewhere, there can be no doubt. There appears to be ample room to exploit the breed in New Zealand to the advantage of the Dominion and the Friesian breeders as well.

In four of the seven classes into which this breed is divided according to age the average yield has been substantially increased during the past year. The classes for the mature animals and junior and senior two-year-olds are in receipt of stronger support than are the classes for three- and four-year-olds. It is pleasing to see that both classes for two-year-olds show increased production.

The tabulated figures for 1919 and 1918 respectively are as follows:—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
		1919.	lb.	lb.
Junior two-year-old	12	350	11,713.8	417.68
Senior two-year-old	11	358	13,393.1	482.24
Junior three-year-old	6	358	13,781.1	502.37
Senior three-year-old	4	327	12,154.3	410.00
Junior four-year-old	8	349	14,786.6	514.27
Senior four-year-old	2	287	13,150.5	468.57
Mature	18	334	15,064.0	523.59
		1918.		
Junior two-year-old	18	349	11,281.0	407.32
Senior two-year-old	10	345	9,982.3	374.06
Junior three-year-old	5	351	13,101.1	465.05
Senior three-year-old	6	331	14,493.5	487.38
Junior four-year-old	5	365	15,779.1	576.13
Senior four-year-old	7	363	13,469.3	480.97
Mature	20	349	14,600.4	528.14

C.O.R. Bulls.

During the year the names of three bulls have, been added to the list of those that have four C.O.R. daughters from as many different dams. Mutual Piebe of Rock (Imp.) is one of this trio, and had more daughters to win a C.O.R. during the year than had any other bull in the complete list. Two daughters of Woodcrest Hengerveld Mechthilde (Imp.) qualified during the year, thus raising his total to five. King of the Dominos, recently sold at Mr. Lovelock's sale to Mr. Neil Carter, has also qualified for the list with an increase of two daughters

during the year, making his total now four. The list at the end of the year stands as follows:—

Name of Bull.	Total of C.O.R. Daughters.	Number of Daughters qualified during 1919.	Name of Bull.	Total of C.O.R. Daughters.	Number of Daughters qualified during 1919.
Cliffside Laddie ..	17	2	Edinglassie ..	7	..
King Segis Wild Rose	15	1	Mutual Piebe of Rock*	7	6
Homestead			Colonel Manor of	6	..
Sir de Kol Inka Pie- tertje	14	1	Riverside		
Kruger II ..	13	..	Colantha Johanna Lad	5	1
Longbeach Van Tromp	12	2	Dominion de Kol	5	..
Grace's Netherland of Riverside	10	..	Domino		
Nazli de Kol ..	10	..	Oak de Kol II Home- stead Fobes	5	..
Paul Pietertje ..	9	..	Woodcrest Hengerveld	5	2
Mutual Piebe de Kol	9	2	Mechthilde*		
Prince Pietje Paxton	9	2	Netherland King ..	4	..
De Kol Pontiac Burke	8	..	Pietertje Boy ..	4	..
King Fayne Segis II	8	3	Longbeach Dutchman	4	..
			King of the Dominos*	4	2

* Qualified during 1919

JERSEYS.

The development of the Jersey in New Zealand has been intensely fostered for a longer period than has been the case with any of the other special-purpose dairy breeds. It would be a reasonable expectation, therefore, that they should be represented in our certificate-of-record work in greater numbers than the Friesians, Milking Shorthorns, or Ayrshires. Such is certainly the case, and from the Jersey breeders' point of view a most satisfactory feature is that a substantial proportion of the certificates going to the breed are claimed by junior two-year-olds, which include heifers up to the age of 2 years 92 days.

Class-leaders.

The Jerseys are divided into five classes. Only in the two-year-olds are there juniors and seniors, the former including all animals up to 2 years 92 days, and the latter those 2 years 93 days and under 3 years of age.

Madam Mayflower has held the leadership of the mature class for several years. She is now replaced by Sultan's Daisy, who increases the record for the class leadership by over 200 lb. of butterfat. This is a remarkable advance in the figures, and the yield of Sultan's Daisy attracts even more attention by being over 230 lb. of butterfat in excess of the next highest class-leader. Not only does Sultan's Daisy become the mature-class leader, but her record also entitles her to the title of New Zealand champion Jersey butterfat-producer.

Woodstock's Baby has joined the list of class-leaders this year by replacing Sultan's Clematis in the class for three-year-olds. This has raised the maximum for the class by some 16 lb. of butterfat.

The record of Mere, made as a yearling, in the junior two-year-old class, still stands as the class-leadership, and is higher than that of the other classes under four years.

The 1919 class-leaders are,—

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
<i>Junior Two-year-old.</i>		Y. dys.	lb.		lb.	lb.
Mere	F. S. McRae, Palmers- ton North	1 346	240.5	365	12,164.00	663.64
<i>Senior Two-year-old.</i>						
Lady Peggy ..	E. Griffiths, New Ply- mouth	2 357	276.2	365	9,625.50	650.00
<i>Three-year-old.</i>						
Woodstock's Baby ..	Mrs. A. Banks and Son, Kiwitea	3 302	307.2	365	12,329.70	657.91
<i>Four-year-old.</i>						
Lady of Collingwood	The late F. E. Hellyer, Dunedin	4 86	322.1	365	12,096.50	736.07
<i>Mature.</i>						
Sultan's Daisy ..	E. O'Sullivan and Sons, Tariki	6 344	350.0	365	13,502.70	968.22

Class-averages.

The Jersey classes, without exception, represent creditable increase in numbers of animals receiving certificates. The average number of days in milk for heifers in the junior two-year-old class and cows in the mature class are the same as those indicated for these classes for 1918. The average milking-period for the three-year-olds and four-year-olds is somewhat shorter. Despite this the average yield for each of these classes shows an increase. Although the classes for senior two-year-olds and mature cows show a little reduction in yield for the average of each class, the increases in production in the other three classes are much more marked. The general position in this respect is therefore eminently satisfactory.

The figures for 1919 and 1918 are as follows:—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
1919.				
Junior two-year-old	62	343	6,579.00	369.93
Senior two-year-old	20	345	6,915.30	402.07
Three-year-old	27	337	7,815.40	442.42
Four-year-old	18	329	8,183.10	467.25
Mature	37	344	8,555.40	470.40
1918.				
Junior two-year-old	50	343	6,321.85	356.29
Senior two-year-old	14	341	7,332.20	408.34
Three-year-old	17	345	7,451.60	416.66
Four-year-old	14	340	8,062.94	448.41
Mature	26	344	8,604.01	475.26



SULTAN'S DAISY.

Leader of the Jersey mature class, and champion Jersey cow of New Zealand.



CAMPANILE'S SULTAN.

Sire of Sultan's Daisy and other C.O.R. cows.

C.O.R. Bulls.

Nine Jersey bulls have been added to the list during the year. Of the new bulls, Soumise Majesty has added four C.O.R. daughters, making his total now stand at seven. Admiral of Puketapu, whose name appeared in the 1918 list, has an accretion of six certificated daughters during the year, making his total stand at fifteen. This pairs him with Roberts for fourth place in the list of forty-one bulls, which is as follows :—

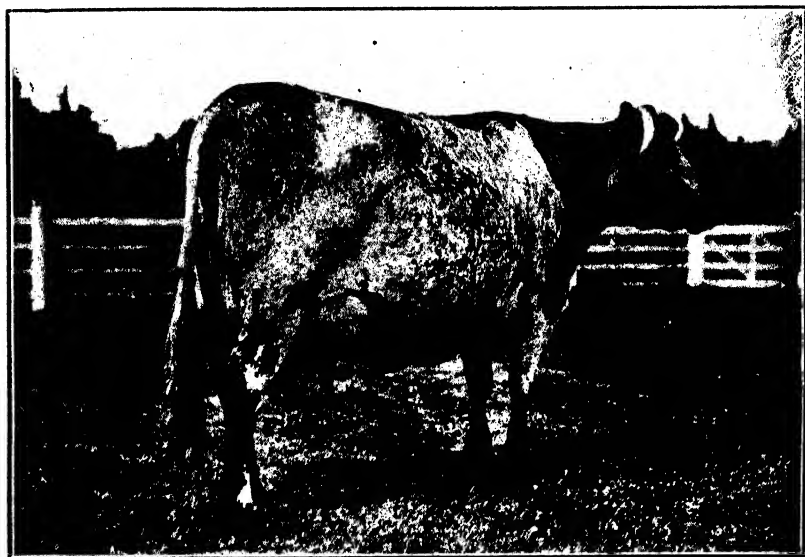
Name of Bull.	Total of C.O.R. Daughters.	Number of Daughters qualified during 1919.	Name of Bull.	Total of C.O.R. Daughters.	Number of Daughters qualified during 1919.
Majesty's Fox ..	24	..	Sunflower's Perseus*	6	2
K.C.B. ..	22	..	Lord Lepperton ..	5	..
Eminent's Fontaine ..	22	3	M.H.R. ..	5	1
Roberts ..	15	2	Brighton Twylish ..	5	1
Admiral of Puketapu ..	15	6	Silver King (Stuckey's)	5	..
Fancy's Lord Twylish	10	3	Belvedere Butter Boy	5	..
Campanile's Sultan ..	9	1	Good Luck ..	4	..
M.L.C. ..	9	1	Glory ..	4	..
Starbright ..	9	..	Young Emperor III	4	..
Rozel's Sultan ..	9	..	Fancy's Carnation's	4	..
Bilberry's Goddington	9	5	Fox	..	..
Blizzard ..	7	..	Marcus* ..	4	1
Frisky Campanile ..	7	1	Knight Commander..	4	..
Soumise Majesty* ..	7	4	Farleigh Fox* ..	4	3
Pride of Egmont ..	6	..	Nestor of Willowbank*	4	3
Stevenson ..	6	..	Petune's Noble* ..	4	2
Goddington ..	6	..	Sunlight's Noble	4	3
Golden Swan ..	6	..	General*	..	..
Grand Duke ..	6	..	Silverlock's Duke* ..	4	1
Mabel's Dairyman ..	6	..	Bush Boy* ..	4	3
Molina's General ..	6	..	Yankee Sweet* ..	4	2
Charm's Lord Twylish	6	1			

* Qualified during 1919.

MILKING SHORTHORNS.

Members of the Milking Shorthorn Association have been taking advantage of the C.O.R. testing facilities in a manner which surpasses all previous efforts. Many dairymen will be pleased to see this breed of British origin qualify for a secure position in New Zealand dairying. It would appear that it is only an extensive patronage of certificate-of-record testing that will assure this. The show-ring is being patronized by the Milking Shorthorn breeders as well as by members of the other cattle-breeders' associations. The demand which the shows are making for straight-lined animals, together with the inherent desire of many Milking Shorthorn breeders for long pedigrees, appears to have a tendency to induce some breeders to develop the "shorthorn" characteristics rather than the "milking" factors. As the case presents itself to us, only the C.O.R. testing can act as an effective brake against such a trend becoming too general.

The enthusiastic support which many of the Milking Shorthorn breeders are giving the yearly testing is bringing a number of their animals into prominence. The proportion of C.O.R. females is in need of very considerable increase, since there are more owners of registered Milking Shorthorns than there are members of any of the "special-purpose" dairy-breed associations. As the testing extends it may be possible for young dairymen to buy registered Milking Shorthorn bulls that are from C.O.R. dams, and are sired by a registered bull of a dairy strain and who has a dam with a satisfactory C.O.R. From the point of view of improving the yield of the average herd cow such a record behind the young bull's sire is likely to suit the dairyman better than a long beef pedigree.



DOMINION EMPRESS V.

A C.O.R. member of the Ruakura Milking Shorthorn herd.

Class-leaders.

The leadership of the four classes of Milking Shorthorns has experienced a change in the four-year-olds during the year. Cora, owned and tested by the Ruakura Farm of Instruction, has been superseded by Matangi Strawberry II, owned and tested by Messrs. Ranstead Bros. The work which the latter have been doing with their test cows has doubtless tended to popularize the breed very considerably. With one of their cows they were a strong competitor for the leadership of the mature class. This honour appears to be strongly held by Willowbank Beauty, who is the only leader in the 600 lb. butterfat class.

The leaders as they stood at the end of 1919 are,—

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
<i>Two-year-old.</i> Joyce II of Hillview	W. Wright, Matapu, Hawera	Y. dys. 2 215	lb. 262·0	365	lb. 9,860·00	lb. 365·34
<i>Three-year-old.</i> Dominion Daphne V	Central Development Farm, Weraeroa	3 303	307·3	354	11,033·60	427·90
<i>Four-year-old.</i> Matangi Strawberry II	Ranstead Bros., Matangi	4 351	349·6	365	12,774·60	473·50
<i>Mature.</i> Willowbank Beauty	S. G. Morgan, Ngawapurua	*	350·0	365	15,725·80	655·22

* Mature

Class-averages.

This is the first year that the Milking Shorthorn breed has had sufficient numbers tested and qualified for certificate of record to warrant the compilation of the average production of each class. We are not in a position, therefore, to give comparisons between the work of this and preceding years.

It will be noted that the mature class has been fairly strongly supported. Interest in testing should be increased as the female progeny of these mature cows come into profit and under test. Although the class-averages are not quite so high as those of the other breeds some of the supporters of Milking Shorthorns hope to make a better showing when they have had more time to segregate their dairy strains from those representing beef. The elimination of the beef inheritance should have an influence in the direction desired by the dairyman and the breeder who is catering for the dairyman's requirement. If this can be successfully accomplished these class-averages should show an annual improvement.

The table of figures for the year is as follows :—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
Two-year-old	7	351	lb. 7,238·6	lb. 294·92
Three-year-old	3	352	8,388·7	339·62
Four-year-old	6	331	10,499·9	423·38
Mature	40	334	10,748·5	425·65

AYRSHIRES.

The year has scarcely evidenced the increase in the testing of Ayrshires that we desired. During 1918 three breeders were on our testing officers' programmes. Two of these discontinued, but three

others came in, leaving the total at four in 1919. Now that testing is becoming more firmly established each year it is to be hoped we shall have an increase in the number of testing Ayrshire breeders compatible with the worth of the breed to the dairying industry.

Bluebell of Riverside, owned and tested by C. B. Morgan, of Ngawapurua, annexed a C.O.R. on a production of 526.15 lb. butterfat. With this she supersedes Adelaide II of Waipapa as leader of the three-year-old class, and raises the class-leadership by 100 lb. butterfat. All four class-leaders are now in the 500 lb. list.

The dam of Bluebell of Riverside was sired by a son of Victor, who is said to have been a bull above the average in transmitting factors for production. On the sire's side of the pedigree appear the names of Rita, Fascination, and Ada III, matrons which have been recognized as heavy producers, although they have never been on C.O.R. test.

The production of Bluebell of Riverside should encourage breeders of this and other good strains of Ayrshires to undertake the authenticating of records of other individuals of the known good lines.

Two certificates of record were issued to Ayrshires during the year. In addition to the one received by Mr. C. B. Morgan on the production of Bluebell of Riverside, Mr. A. H. Hansen's Princess II of Porirua received a certificate for 483.63 lb. butterfat in the mature class. The number of Ayrshire cows receiving certificates is so small that we are not in a position to publish class-averages as has been the case with the other breeds. The statement of the class-leaders at the end of the year is as follows :—

Name of Cow and Class.	Tested by	Age at starting Test.	Fat reqd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
<i>Two-year-old.</i>		Y. dys.	lb.		lb.	lb.
Kanadale Linda ..	Cockburn Bros., Mataura	2 348	275.3	365	12,583.00	502.55
<i>Three-year-old.</i>						
Bluebell of Riverside	C. B. Morgan, Ngawapurua	3 14	278.4	365	11,229.00	526.15
<i>Four-year-old.</i>						
Alexandra of Waipapa	F. Mills, Waipapa, Hawera	4 348	348.3	365	14,348.60	591.16
<i>Mature.</i>						
Alexandra of Waipapa	F. Mills, Waipapa, Hawera	6 354	350.0	365	14,636.00	582.47

SECOND-CLASS CERTIFICATES.

Breeders who have been testing cows for certificates of record have been at some inconvenience in publishing either in sale catalogues or in advertisements the records of tested cows which failed to get certificates owing to calving a few days late after test. The suggestion that second-class certificates might be granted was made. The matter was discussed with the executives of the principal breeders' associations

co-operating in the work, safeguards were decided upon, and what appears to be a satisfactory working arrangement was approved by the executives and later by the Department. This arrangement is embodied in the new rules, a copy of which has been forwarded to each testing breeder. The second-class certificate will be forwarded to the owner of a cow qualifying for same as from the 1st January, 1920.

APPRECIATION.

The development in the testing-work among breeders of registered dairy stock has very considerably increased the work of the secretaries of most of the associations concerned. They sign applications to the effect that the cow being entered for test is registered in the records of the respective associations. They receive copies of the certificates, and after tabulating these the secretaries of the Jersey and of the Friesian associations prepare their copy for those excellent publications, the "Jersey Advanced Register of Merit" and the "Friesian Year-book." In at least one secretary's office tables of the monthly records are prepared for publication in the official organ of the association. The correspondence of the secretaries has been increased, and to this has been added the issuing of forms connected with the entry of C.O.R. animals in classes for C.O.R. cows at some of the agricultural shows.

The manner in which the secretaries have co-operated with the Dairy Division has been most pleasing and is gratefully acknowledged. The enthusiastic support and sympathetic interest of the executives of the associations has tended to make the work profitable to the Dominion and encouraging to the breeders.

The success of the C.O.R. testing-system depends very largely on the integrity of the testing officers. Their hours of duty are early and late, in all kinds of weather. Their devotion to duty and their straightforward conduct have assisted in a marked degree towards the success attained.

CLOSING LIST OF RECORDS FOR 1919.

In the appended concluding list for the year are some very fine records among both the Friesians and the Jerseys, while the Ayrshires contribute one of special merit.

H. North and Sons have received certificates on three Friesian records. In the junior two-year-old class Rosevale Stella stands highest in the list. She is from Helena Plus Girl, which was imported from Canada. The sire of this imported cow was from a dam with a record of 22,304 lb. of milk, containing 764.94 lb. butterfat. The sire of Rosevale Stella is Netherland King of Rosevale. This bull is a son of Longbeach Netherland Queen VII, who has a certificate of record for 659.31 lb. butterfat.

The list also contains two other very creditable records made by animals owned by Messrs. North. These cows are Rosevale Rhoda Posch and Rosevale Pietje Korndyke. They are both in the four-year-old class, and each is sired by Bruce of Pleasant Valley, who was imported from Canada. His sire has a number of tested daughters, and his dam is from a cow that has produced at least two tested daughters. One of these has a record of 575 lb. butterfat. Each of these four-year-olds is from a Canadian-bred dam.

Dutchland Colantha Cadillac has completed a good record in the mature class. She had been on test previously, but on subsequent calving failed to get a certificate for her production of 18,739.7 lb. milk, containing 670.63 lb. butterfat. She is a daughter of Colantha Johanna Lad, and was imported by W. I. Lovelock. At Mr. Lovelock's recent sale she was purchased by the Bloomfield Farm Company at 212 guineas, a price that was exceeded at this sale only by her daughter, Colantha Lass of Conemaugh, at 220 guineas.

Among the Jersey figures of this list will be seen the records of two three-year-olds in the 600 lb. class and one 500 lb. record in the mature class. The highest credit was won by Woodstock's Fancy Free. This is her second year on test. Her previous record was started on her second birthday, and she won a certificate for a production of 630.15 lb. butterfat. During her second lactation period she has improved this by 10.88 lb. fat. Woodstock's Fancy Free is a daughter of Fancy's Lord Twylish from a daughter of Eminent's Fontaine. Fancy's Lord Twylish has now ten C.O.R. daughters, and Eminent's Fontaine twenty-two. The maternal grandam of Woodstock's Fancy Free is by Duke of York, who sired three C.O.R. daughters, including Lenora, who won a certificate for 685.18 lb. butterfat.

Mr. Dermer bred the dam of Woodstock's Fancy Free, and he also bred Waipiko Lena, the other 600 lb. three-year-old figuring in this list. Waipiko Lena was sold at Mr. Dermer's sale, and completed her record at G. McKenzie's, Waitara. She is from Eminent's Lenora, a 518.59 lb. butterfat daughter of Lenora by Eminent's Fontaine. Waipiko Lena was sired by Bilberry's Goddington, who now has nine C.O.R. daughters, among which Waipiko Lena has the best record. The dam of Bilberry's Goddington is by K.C.B., who now has twenty-two C.O.R. daughters.

A somewhat different line of breeding is responsible for Neat Olga, in the mature class, who has produced 583.25 lb. butterfat. She is a line-bred Campanile Sultan cow, her sire, Mermaid Sultan, being a son of this imported bull and her dam a granddaughter. Mermaid Sultan has now four C.O.R. daughters. A four-year-old daughter, Sultan's Lass, has a certificate for 580.4 lb. butterfat.

Yankee Sweet, who was sire of the dam of Neat Olga, has four C.O.R. daughters. Michaelmas Day has the highest record among these, at 480.87 lb. butterfat. The record of Sultan's Daisy will have materially strengthened any pedigree such as that of Neat Olga's. Sultan's Daisy, with her record of 968.22 lb. butterfat, is half-sister to Neat Olga's sire and to her maternal grandam.

The record made by Bluebell of Riverside has been commented on in the annual review.

LIST OF RECORDS.

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cent.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS.						
<i>Junior Two-year-old.</i>		Y. dys.	lb.		lb.	lb.
Duchess of Woodstock	Mrs. A. Banks and Son, Kiwitea	2 61	246·6	365	8,319·0	430·45
Renown's Carnation	F. J. B. Ryburn, Paterangi	2 25	243·0	365	6,264·7	299·38
Successful Queen ..	Mrs. C. A. McKenzie, Carnarvon	2 42	244·7	283	4,532·6	256·32
Charm's Sensation ..	G. Buchanan, Paeroa	1 133	240·5	342	5,591·2	248·30
<i>Senior Two-year-old.</i>						
La Poupee ..	F. J. B. Ryburn, Paterangi	2 266	267·1	365	7,021·5	426·06
Waipiko Geraldine ..	J. Haskins, Manutuke	2 339	274·4	347	6,284·7	356·80
Dominion Myrtle of Ruakura	Ruakura Farm of Instruction, Hamilton	2 358	276·3	365	5,183·8	334·08
<i>Three-year-old.</i>						
Woodstock's Fancy Free	Mrs. A. Banks and Son, Kiwitea	3 60	283·0	365	12,234·4	641·03
Waipiko Lena ..	G. McKenzie, Motunui	3 128	289·8	365	10,474·4	622·37
Waipiko Penelope ..	A. H. Guy, Kaponga	3 93	286·3	365	9,103·5	498·34
Melia Ann's Sweet ..	W. T. Luxton, Waitara	3 343	311·3	365	6,852·0	436·50
Gold Ring ..	H. R. Benbow, Ormondville	3 276	304·6	365	6,804·2	406·94
Waipiko Lucia ..	J. Haskins, Manutuke	3 7	277·7	331	6,650·7	326·07
<i>Mature.</i>						
Neat Olga ..	T. Linn, Mangatoki ..	5 11	350·0	365	9,778·3	583·25
Belvedere Cowslip ..	E. B. Eagle, Belvedere	9 40	350·0	365	9,374·8	481·54
Young Sybil II ..	S. R. Lancaster, Palmerston North	11 30	350·0	365	9,989·9	475·19
Zena ..	S. R. Lancaster, Palmerston North	9 23	350·0	271	7,531·9	397·70
FRIESIANS.						
<i>Junior Two-year-old.</i>						
Rosevale Stella ..	H. North and Sons, Omimi	2 91	249·6	365	15,581·9	544·98
Newton Queen Segis	C. A. Fawcett, Clevedon	2 15	242·0	343	10,266·3	347·65
<i>Senior Two-year-old.</i>						
Bainfield V ..	W. D. Hunt, Invercargill	2 218	262·3	365	10,807·2	396·03
<i>Junior Three-year-old.</i>						
Bainfield No. 9 ..	W. D. Hunt, Invercargill	3 11	278·1	365	14,169·6	455·46
Dominion Cornella II	Central Development Farm, Weraoia	3 73	284·3	365	10,330·75	368·64
<i>Senior Three-year-old.</i>						
Segis II Morning Rose	P. Nisbet, Rata ..	3 288	305·8	277	10,976·0	367·51
<i>Junior Four-year-old.</i>						
Rosevale Rhoda Posch	H. North and Sons, Omimi	4 74	320·9	365	20,693·7	645·36
Rosevale Pietje Korn-dyke	H. North and Sons, Omimi	4 73	320·8	365	17,045·4	572·27
Dominion Queen Elizabeth	Central Development Farm, Weraoia	4 51	318·6	344	12,006·0	388·01

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cent.	Yield for Season.		
				Days.	Milk.	Fat.
FRIESIANS—continued.						
Mature.		Y. dys.	lb.		lb.	lb.
Dutchland Colantha	W. I. Lovelock, Palmerston North	9 203	350·0	365	16,380·0	581·68
Cadillac						
Clothilde Mercena de Kol II	C. A. Fawcett, Clevedon	6 233	350·0	323	12,410·4	457·66
Dominion Domino's Pride	Central Development Farm, Weraroa	8 0	350·0	361	12,518·5	427·56
Woodcrest Daisy ..	Ditto	7 230	350·0	309	12,449·5	390·22
MILKING SHORTHORNS.						
Two-year-old.						
Dominion Myth of Ruakura	Ruakura Farm of Instruction	2 276	268·1	343	8,032·2	333·95
Dominion Sally of Ruakura	Ditto	2 322	272·7	365	7,759·7	332·52
Lady Clarence ..	.. ..	2 333	273·6	325	8,027·3	326·68
Dominion Profit of Ruakura	.. ..	2 310	271·5	365	6,428·1	274·37
Dominion Welcome of Ruakura	.. ..	2 223	262·8	343	6,434·7	262·92
Mature.						
Heatherlea Brownie	H. M. Essex, Levin ..	*	350·0	321	9,975·8	401·41
Cloverlea Fancy A2..	A. Parkinson and Son, Opotiki	*	350·0	280	10,989·8	399·98
Empress V ..	Ruakura Farm of Instruction	*	350·0	331	9,412·35	399·51
Pukepai Strawberry	H. M. Essex, Levin ..	*	350·0	349	10,977·1	385·37
Kelvin Side Lizzie ..	Groves Bros., Woodville	*	350·0	245	9,277·9	359·88
Lady Jane ..	C. Lassen, Hastings ..	*	350·0	333	9,504·4	368·00
Waitangi Primrose ..	A. J. McGovern, Kio-kio	*	350·0	315	9,083·6	358·02
AYRSHIRES.						
Three-year-old.						
Bluebell of Riverside	C. B. Morgan, Ngawapurua	3 14	278·4	365	11,229·0	526·15

* Mature.

Professor R. D. Watt, who occupies the Chair of Agriculture at Sydney University, visited the Ruakura Farm of Instruction last month. In connection with Green's Ruakura Oat, he mentioned that this variety was now very extensively grown in Australia.

Fellowship of the New Zealand Institute.—Among the twenty Original Fellows of the Institute, recently elected, are Dr. L. Cockayne, F.R.S., and Mr. B. C. Aston, F.I.C., both of whom are well known to readers of the *Journal* by their contributions.

AN ECONOMIC INVESTIGATION OF THE MONTANE TUSSOCK-GRASSLAND OF NEW ZEALAND.

V. REGENERATION OF GRASSLAND AFTER DEPLETION.

Dr. L. COCKAYNE, F.N.Z.Inst., F.R.S.

GENERAL.

IN article II of this series* an account was given of some of the stages in the evolution of depletion, and it was shown that the presence of the rabbit in excess, and an especially dry climate, were the major factors, while a minor though an important factor was excessive burning of the tussocks. To these causes I would add, as the result of recent field-work, the extensive dying-out of the tussock in certain localities through presumably the attack of the white grub (larva of *Odontria zealandica*); nor should the effect of overstocking by sheep be underestimated.

In this article the reverse side of the picture is presented in an account of certain specific cases of regeneration in the depleted areas of the South Island, especially Central Otago. These examples, with but one exception, are taken from what may be styled "unpremeditated experiments," certain areas—usually small—of depleted grassland having been fenced from rabbits for the protection of orchards, cultivation of crops, experimental forestry, or other purposes. In some cases small portions of the fenced-in areas have not been interfered with, and there examples of regeneration occur; in other cases regeneration has taken place over the whole area; finally an example is given where regeneration has come about in the presence of cattle, sheep, and horses, but under circumstances where a good deal of food more palatable than the regenerating tussocks was available.

Unfortunately, in the examples cited there is no record of the progress of events, nor are details procurable regarding the exact degree of depletion of the area at the time of its enclosing, nor of the species then composing the plant-covering; all that can be stated is the condition of the new vegetation at the time of its examination. All the same, the facts thus brought to light are of no small economic value, for they form a basis for arranging the all-important detailed experimental work which is essential for further advance.

As explained in article IV of this series, it is not known whether regeneration is due to plants arising from seeds, or to plants already in the ground at the time it was enclosed by the rabbit-proof fence. A solution of this simple problem is much needed; for, if it turns out that regeneration may arise from seedlings, a powerful weapon is to hand with regard to the regressing of Central Otago. The foregoing

* Published in the *Journal* for September, 1919.

remarks apply only to the indigenous species. Evidence is accumulating that certain introduced grasses, clovers, and other plants, at times—possibly frequently, indeed—gain the enclosed areas through seed carried from without. In this article cases of this kind are suggested.

Before proceeding to the detailed accounts of examples of regeneration noted by me I must take this opportunity of recording my great obligations to Mr. R. K. Smith, of Tarras, in this and many other matters concerning sheep-farming in Central Otago. Mr. Smith spent a long day in motoring me round the Tarras district, showed me several important examples of regeneration at different stages, gave me an opportunity of seeing various classes of grassland and cultivation, and on various occasions since has supplied me with much valuable information—otherwise unobtainable—the result of his many years' critical experience of Central Otago. To Mr. D. Middleton, of Northburn Station, near Lowburn Ferry, who has also assisted me in many ways and shown me much of great moment, I must likewise record my hearty thanks. I am also greatly indebted to Mr. H. E. Cameron, of Hakataramea, who motored me to his Glen Avon Station, Upper Ahuriri Valley, and pointed out place after place of interest along the road, with the history of which concerning rabbits, burning, and stocking he was fully acquainted.

SOME SPECIAL EXAMPLES OF REGENERATION.

(1.) *Mr. R. K. Smith's Farm, Tarras.*

Near his new homestead Mr. R. K. Smith has made an important experimental plantation of various kinds of trees. These receive no mention here, as tree-growing—a most important matter with regard to regeneration—should form the subject of a future article. The special point to note is that the plantation is surrounded with a rabbit-proof fence, which was put up about six years ago. The ground is flat.

I have no exact details of the pasture-plants present. The important fact, however, is that there is a great deal of blue-grass (*Agropyron scabrum*). As usually seen in montane tussock-grassland throughout New Zealand this species grows in the tussocks themselves; there is none in the spaces between the tussocks. As an inmate of a tussock the grass consists merely of a straggling stem or two, at the base of which are a few rather insignificant leaves; but in this plantation and elsewhere, where stock (including rabbits) cannot get at it, it forms quite large but rather lax tussocks with abundant leaves. So, too, does the plume-grass (*Dichelachne crinita*), also frequent in this plantation, which usually grows in the tussocks, but here has a tussock-form similar to that of the blue-grass. It looks, indeed, as if in the presence of stock neither of these species get a chance to develop, and that the plants in the tussocks are merely survivors in a haven of refuge.

A most interesting point is that in this plantation there are many seedlings of the blue-grass and that these seedlings show many individual differences. I have never noted an adult specimen of blue-grass persisting in a depleted area, but only young plants growing on scabweed mats or cushions. It is certain that many of the specimens in this plantation have originated from seed, and this may apply

generally to other enclosed areas where there is more or less of this grass.

- (2.) *Ground near the new Tarras Homestead which had been ploughed but nothing further done to it.*

There was no opportunity to make a close examination of this area. The following is a list of the species, in alphabetical order: *Agropyron scabrum* (blue-grass), *Crepis capillaris* (hawksbeard), *Dactylis glomerata* (cocksfoot), *Danthonia Buchanani* (Otago danthonia), *Dichelachne crinita* (plume-grass), *Festuca novae-zelandiae* (fescue-tussock), *Hypochaeris radicata* (catsear), *Poa intermedia* (tall blue-tussock), *Poa pratensis* (meadow-grass), *Trifolium dubium* (suckling-clover), *Trifolium pratense* (red clover), and *Triodia Thomsoni* (Otago triodia). Hawksbeard and suckling-clover grew on the stoniest part of the ground.

- (3.) *Piece of Originally Depleted Hillside near Mr. Mackay's House, Tarras.*

On this piece of land there are areas representing three stages—namely, one unfenced and frequented by many rabbits, one fenced from rabbits for nearly two years, and one continuous with the garden and fenced in for nearly five years.

Stage 1: This is continuous with stage 2. Such vegetation as exists is cropped most closely by rabbits; indeed, apparently it contained hardly any available feed. The principal species were sorrel (*Rumex Acetosella*) and annual fescue (*Festuca myuros*)—dry and dead at the time of examination. Other species present are cited below.

Stage 2: In general aspect this area differs *in toto* from that of the adjacent rabbit-infested area (stage 1). There is still much bare ground. The following is an incomplete list of the species: *Aira caryophyllea* (hair-grass), *Anagallis arvensis* (pimpernel), *Carex resectans* (desert-sedge), *Centaureum umbellatum* (centaury), *Cheilanthes Sieberi* (common lip-fern), *Crepis capillaris* (hawksbeard), *Convolvulus erubescens* (trailing bindweed), *Festuca myuros* (annual fescue), *Geranium sessiliflorum* var. *glabrum* (short-flowered cranesbill), *Holcus lanatus* (Yorkshire fog), *Hypericum gramineum* (erect St. John's wort), *Oxalis corniculata* (yellow oxalis), *Raoulia australis* (common raoulia), *Raoulia Beauverdii* (Otago raoulia), *Rumex Acetosella* (sorrel), *Triodia Thomsoni* (Otago triodia), *Wahlenbergia albomarginata* (New Zealand bluebell). The greater number of these species are also to be found on the denuded ground, but in much worse condition and with far fewer individuals. On the other hand, the palatable species, Yorkshire fog and hawksbeard, have gained a footing.

Stage 3: This, the oldest portion, continuous with the garden, contained plants in abundance. The following is an incomplete list: *Agropyron scabrum* (blue-grass), *Carmichaelia Petriei* (thick-stemmed broom), *Centaureum umbellatum* (centaury), *Crepis capillaris* (hawksbeard), *Dichelachne crinita* (plume-grass), *Festuca novae-zelandiae* (fescue-tussock), *Holcus lanatus* (Yorkshire fog), *Hordeum murinum* (barley-grass), *Hypochaeris radicata* (catsear), *Poa intermedia* (tall blue-tussock), *Sonchus oleraceus* (sow-thistle), *Trifolium arvense* (haresfoot trefoil), *Trifolium pratense* (red clover). This list is extremely instructive, for almost all its species are more or less palatable.



FIG. 1. DEPLETED HILLSIDE GROUND IN DUNSTAN GORGE, OUTSIDE ORCHARD MENTIONED ON PAGE 86.

The large plants are horehound.



FIG. 2. REGENERATED GRASSLAND IN ORCHARD ENCLOSURE DESCRIBED ON PAGE 86.



FIG. 3. ANOTHER VIEW OF SAME REGENERATED AREA.

Note the red clover in foreground.

[Photos. T. L. Wright]

(4.) *A Steep Depleted Hillside in the Dunstan Gorge.*

This is a specially interesting example of regeneration, since it has taken place in a situation similar to so much of Central Otago where neither cultivation nor irrigation is feasible. A piece of ground was fenced from rabbits, perhaps about ten years ago, for the purpose of planting an orchard on the fenced-in land. The steep ground near the fence, separating the upper portion of the area from the barren hillside, has not been made use of, and the vegetation now occupying it has come spontaneously without watering or cultivation. This ground has a southerly aspect, but is exposed to the violent north-west wind.

Vegetation of hillside outside the fence: This is well shown in the photograph (Fig. 1). The plant-covering on the depleted hillside is denser than is usual for such an area, owing to the abundance of horehound (*Marrumbium vulgare*)—a plant of extremely low palatability—and to the southerly aspect of the slope, but its value as pasture is trifling. The following is a list of species: *Anagallis arvensis* (pimpernel); *Carduus pycnocephalus* (winged thistle); *Gilia squarrosa* (Californian stinkweed); *Marrumbium vulgare* (horehound); *Oxalis corniculata* (yellow oxalis); *Poa Colensoi* (blue-tussock)*—a tuft or two eaten to the ground, most likely by rabbits; *Raoulia lutescens* (scabweed); *Sonchus arvensis* (sow-thistle)—only a little, and greatly eaten; *Stellaria gracilentia* (mountain-chickweed); *Triodia Thomsoni* (Otago triodia)—a few plants eaten to the ground; *Wahlenbergia gracilis* (slender blue-bell).

Vegetation of hillside inside the fence: There was an extremely dense vegetation about 18 in. deep, made up principally of grasses (see Figs. 2 and 3). The following is a list of the species: *Agropyron scabrum* (blue-grass); *Carmichaelia compacta* (Clutha broom)—in great quantity in places; *Crepis capillaris* (hawksbeard); *Dactylis glomerata* (cocksfoot); *Discaria toumatou* (wild-irishman); *Dichelachne crinita* (plume-grass); *Hypochaeris radicata* (catsear); *Lolium perenne* (rye-grass); *Marrumbium vulgare* (horehound); *Oxalis corniculata* (yellow oxalis); *Poa intermedia* (tall blue-grass); *Poa pratensis* (meadow-grass); *Rosa rubiginosa* (sweetbrier); *Trifolium pratense* (red clover).

(5.) *The Clyde Cemetery.*

This is situated on the flat ground near Clyde. The chief feature of the vegetation is the number of fine tussocks of blue-grass (*Agropyron scabrum*), some of which measure no less than 2 ft. through. In the shade of the poplar-trees there is more or less cocksfoot. The following is a list of the species noted: *Agropyron scabrum* (blue-grass), *Aira caryophylllea* (hair-grass), *Bromus sterilis* (barren brome-grass), *Crepis capillaris* (hawksbeard), *Cytisus scoparius* (broom), *Dactylis glomerata* (cocksfoot), *Hordeum murinum* (barley-grass), *Linum marginale* (Australian flax), *Poa intermedia* (tall blue-grass), *Poa pratensis* (meadow-grass), *Rosa rubiginosa* (sweetbrier), *Rumex Acetosella* (sorrel), *Verbascum Blattaria* (smooth-leaved mullein).

This case is perhaps not one of regeneration, but merely of persistence of tussock, &c., when the causes of depletion are removed.

* This may be *Poa intermedia* (tall blue-tussock).



FIG. 4. VIEW OF INTERIOR (LEFT OF FENCE) AND EXTERIOR OF EARNSCLEUGH EXPERIMENTAL AREA IN 1911.

Darker colour of interior caused by growth of sorrel which came about shortly after area was enclosed.

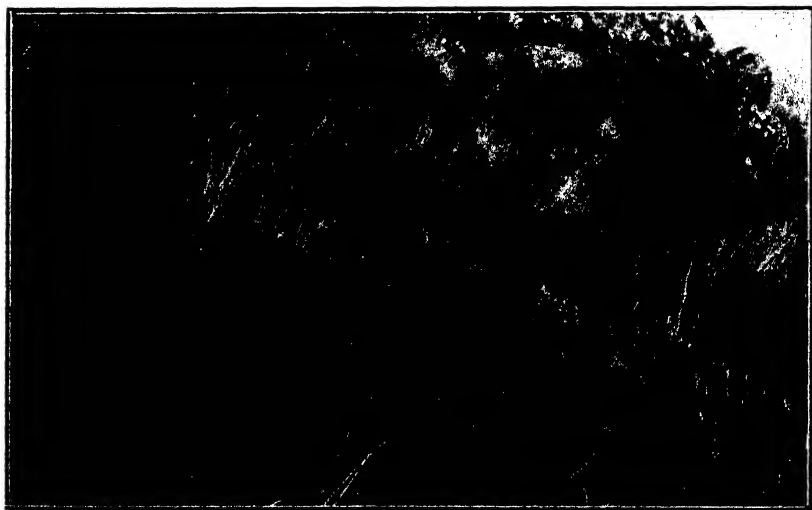


FIG. 5. RECENT VIEW IN EARNSCLEUGH EXPERIMENTAL AREA. FACING SOUTH.

This was absolutely depleted ground in 1911, but now, as shown, is occupied by a natural growth of blue-grass and tall blue-tussock.

(Photos, L. Coehayne.)

(6.) *The Agriculture Department's Earnscliffe Experiment Area near Clyde.*

This was an area of depleted hillside which was fenced from rabbits by the Department of Agriculture in 1910. Of late years, however, rabbits have infested the area to some extent, so that the regeneration has occurred in the presence of more or less of these animals. Also, about two years ago a fire swept through part of the area, destroying many of the tussocks. The ground is 20 acres in extent. The lowest part, which is not generally steep, was ploughed or scarified, seed-beds prepared, and a considerable number of species of grasses and other plants sown. Regarding the behaviour of these nothing will be said here. The only interesting portion of the area from the standpoint of this article is the extremely steep slope. Even there in some places it looks as if certain grasses had been sown, but this may not have been so, and certainly the regeneration of the tussock and many other species has been spontaneous. As it will be necessary to make a thorough examination of the whole area before commencing certain experiments with regard to palatability which are to be conducted thereon, no complete list of the species is given, nor is anything said regarding the cultivated portion.

Where the ground has a southerly aspect, especially at the upper part of the area, there is a dense growth of tussocks of blue-grass (*Agropyron scabrum*) and tall blue-tussock (*Poa intermedia*) (see Fig. 5). The following palatable introduced plants are also present to some extent: Yorkshire fog (*Holcus lanatus*); meadow-grass (*Poa pratensis*); sow-thistle (*Sonchus arvensis*); lucerne (*Medicago sativa*), but only one plant noted; rye-grass (*Lolium perenne*); and, in places, cocksfoot (*Dactylis glomerata*).

Where the ground has a more or less northerly aspect tussock has come in quite sparingly, but there are many introduced species, and in places the ground is well covered. For instance, catsear (*Hypochaeris radicata*) forms almost mats over many square yards—its rosettes of leaves are so close together; in many places there are tussocks of cocksfoot, and in other places large patches of Yorkshire fog. Occasionally there is a plant of tall oat-grass (*Arrhenatherum elatius*). Without going into further details, the total number of species which have settled on the originally depleted steep ground is forty-two, of which no less than twenty-four may be considered more or less palatable. And it must not be forgotten that this has happened in the presence at times of a considerable number of rabbits; but the better food of the cultivated portion below would supply most of their feed.

(7.) *The Experimental Tree-planting Area at Omarama.*

In 1914 a number of trees of various kinds were planted near Omarama under the direction of Mr. R. G. Robinson (then Superintending Nurseryman for the South Island) and the area planted enclosed by a rabbit-proof fence. The ground is quite flat and the soil fairly good.

At the present time there are wide breadths of tussocks of tall blue-tussock and blue-grass (see Fig. 6). There is a little fescue-tussock (*Festuca novae-zelandiae*). In some parts sorrel is the chief plant. Some of the fescue-tussocks measured 16 in. in height, and the tall blue-tussocks 14 in. There was a little red clover (*Trifolium pratense*), some

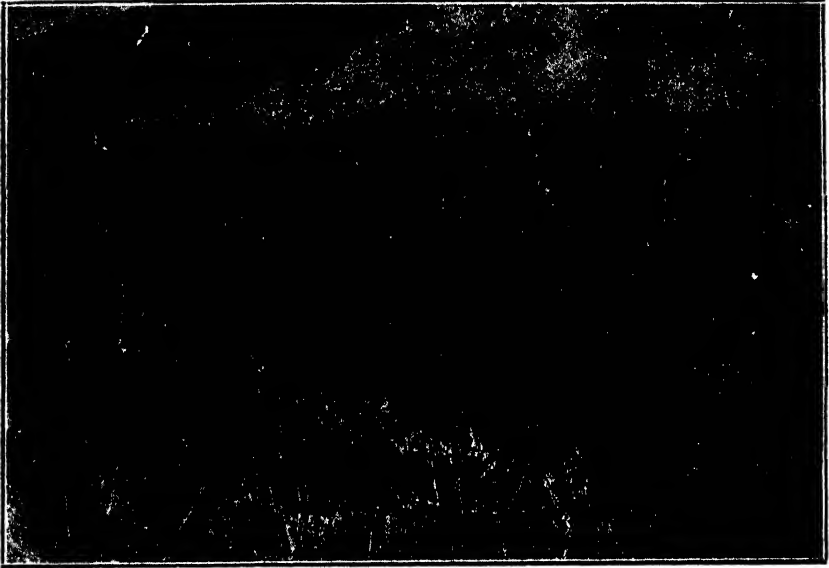


FIG. 6. IN THE OMARAMA EXPERIMENTAL TREE-PLANTING AREA.
Showing close growth of tussocks of blue-grass and tall blue-tussock which has come in five years.



FIG. 7. BOUNDARY OF OMARAMA EXPERIMENTAL TREE-PLANTING AREA.
Showing regeneration inside fence (on left), and depleted ground, with scabweed, outside.

[Photos, W. D. Reid.]

catsear, and some Yorkshire fog. The total number of species noted was sixteen, but this is probably too low. The contrast between the regenerating grassland inside the enclosure and the depletion outside is clearly marked (see Fig. 7). This case of regeneration is not as striking as some recorded in this article, since on the ground outside exposed to both rabbits and sheep there are still a few tussocks here and there of fescue-tussock.

(8.) *The Experimental Tree-planting Area on the Flat Ground on the Summit of the Sugarloaf, near Lowburn (Central Otago).*

The area under consideration is situated on the flat top of the terrace known as the Sugarloaf, at an altitude of about 1,000 ft. above sea-level. The soil is light, but of fairly good quality. The plantation is extremely narrow, and receives the full effect of both the furious north-west and south-west gales. Outside the area the ground is at almost the maximum stage of depletion; there is little else except the scabweed (*Raoulia lutescens*). Yet within the enclosure (see Fig. 8) there are blue-grass tussocks in abundance, some quite 21 in. high, with a spread of 16 in. Here and there are tussocks of tall blue-tussock; there is a little red clover. Many of the blue-grass tussocks have originated on the scabweed cushions (see Fig. 9).

The following is a list of the other species noted: Catsear (*Hypochaeris radicata*), horehound (*Marrubium vulgare*), annual fescue (*Festuca bromoides*), winged thistle (*Carduus pycnocephalus*), hawksbeard (*Crepis capillaris*), plume-grass (*Dichelachne crinita*), Scotch thistle (*Carduus lanceolatus*), barley-grass (*Hordeum murinum*), and Otago raoulia (*Raoulia Beauverdii*).

(9.) *The Cromwell Racecourse Reserve and the Adjacent Uncultivated Land of the Cromwell Development Company.*

The racecourse reserve: This is a specially interesting example of regeneration, since it affords a comparison to be made between rabbit-infested ground, ground where rabbits are virtually absent but under partial grazing-conditions, and ground side by side with the latter but which is not grazed. The reserve is surrounded by a rabbit-proof fence; it is grazed to its full capacity by sheep, together with some cattle and horses, and about 12 acres of the grazed area are irrigated. At the present time on the flat part of the reserve blue-grass tussocks are dotted about, and there is a good deal of rye-grass. There is some catsear, some hemlock storksbill (*Erodium cicutarium*)—a palatable herb—and a number of indigenous unpalatable species. On the steep slope facing south-west is abundance of blue-grass tussocks, sometimes more or less eaten, probably by horses or cattle. They are evidently able to have originated under such conditions and to hold their own. How far they would do so were better feed not usually available is another matter. There is also some tall blue-tussock, rye-grass, sorrel, tufted danthonia (*Danthonia semiannularis* var.), and smooth-leaved mullein (*Verbascum Blattaria*), together with eight species or more of unpalatable plants.

The Cromwell Development Company's land: This refers to the steep ground unsuitable for fruitgrowing. It has been kept free from rabbits and stock for five or six years. About two years ago the grass-



FIG. 8. REGENERATION IN THE EXPERIMENTAL TREE-PLANTING AREA ON THE SUGARLOAF, LOWBURN FERRY.

The tussocks are blue-grass, the trees Monterey pine (*Pinus radiata*, syn. *insignis*).

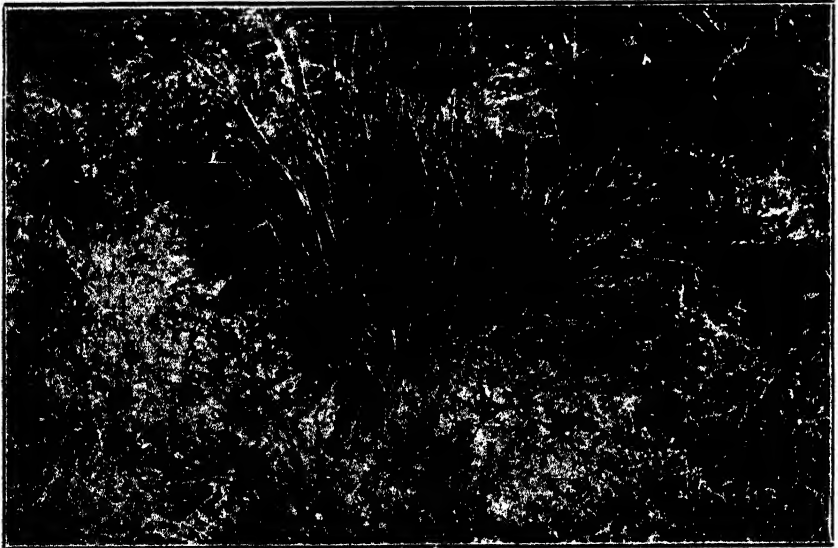


FIG. 9. BLUE-GRASS TUSSOCK GROWING ON SCABWEED IN SUGARLOAF TREE-PLANTING AREA.

[Photos, W. D. Reid.]

land about to be described was burnt accidentally at what is universally considered the wrong season. The chief difference between the ungrazed and the grazed area adjacent is that the tussocks on the former are closer together and larger, while certain palatable species are much more in evidence. On a slope facing south-east the tussocks stand at about 3 ft. apart. Tall blue-tussock is the most abundant, but there is a good deal of blue-grass tussock. Rye-grass is plentiful; there is both white and red clover; between the tussocks the ground is closely covered with catsear, or, in places, with hawksbeard, so that there is little bare ground (see Fig. 10). The tussocks and the red clover are frequently more than 20 in. high. There is a little fescue-tussock. On gravelly ground there are no tussocks, but only sorrel, horehound, some scabweed mats, and a little hawksbeard. On a slope facing north to north-west in its upper, steepest part, tussock has not regenerated. There is only sorrel, pimpernel (*Anagallis arvensis*), sow-thistle (*Sonchus arvensis*), catsear, toothed medick (*Medicago denticulata*), and *Vittadinia australis*, a daisy-like plant as yet without a popular name. As the slope gets less steep the species mentioned continue, but they are reinforced by some blue-grass, and where the slope is still more gentle this grass increases in quantity, white clover appears, and there is more catsear and hawksbeard (see Fig. 11). There is also annual fescue in abundance.

CONCLUSIONS.

1. Regeneration of a depleted area may, if the conditions are favourable, come about through the complete exclusion of rabbits and stock.

2. Even in the presence of a limited quantity of stock, and even rabbits, regeneration may take place.

3. If rabbits alone be excluded, blue-grass (*Agropyron scabrum*) and tall blue-tussock (*Poa intermedia*) can hold their own in the presence of sheep, cattle, and horses so long as there is a fair amount of other feed present.

4. Blue-grass and tall blue-tussock are early arrivals, and both increase rapidly by means of seeds.

5. Blue-grass assumes the tussock-form—a growth-form altogether different from that of this plant when growing within the shelter of a fescue-tussock or a poa-tussock.

6. The plume-grass (*Dichelachne crinita*) behaves in all particulars regarding its growth-form like the blue-grass, but it is far more uncommon, and cannot spread so rapidly.

7. Many other plants may gain a footing in enclosed ground and spread rapidly, especially sorrel, catsear, hawksbeard, Yorkshire fog, barley-grass, and annual fescue.

8. Even one year's exclusion of rabbits and sheep leads to a considerable increase in the amount of vegetation, sorrel being usually the first palatable plant to appear in quantity.

9. Cocksfoot can naturally increase in an area shut up from stock and rabbits, and can become established under drier conditions than tussocks of indigenous grasses.

10. Red clover (at times) and white clover (frequently) occur as plants of regenerating pasture.

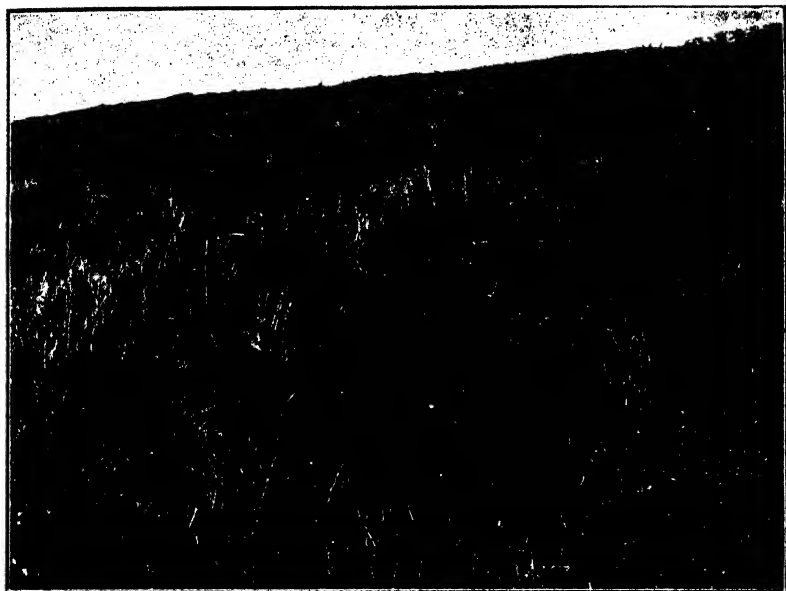


FIG. 10. REGENERATED AREA ON CROMWELL DEVELOPMENT COMPANY'S LAND.

Totally depleted at time of erection of rabbit-fence six years ago; now covered with dense growth of tall blue-tussock, blue-grass, and other plants.

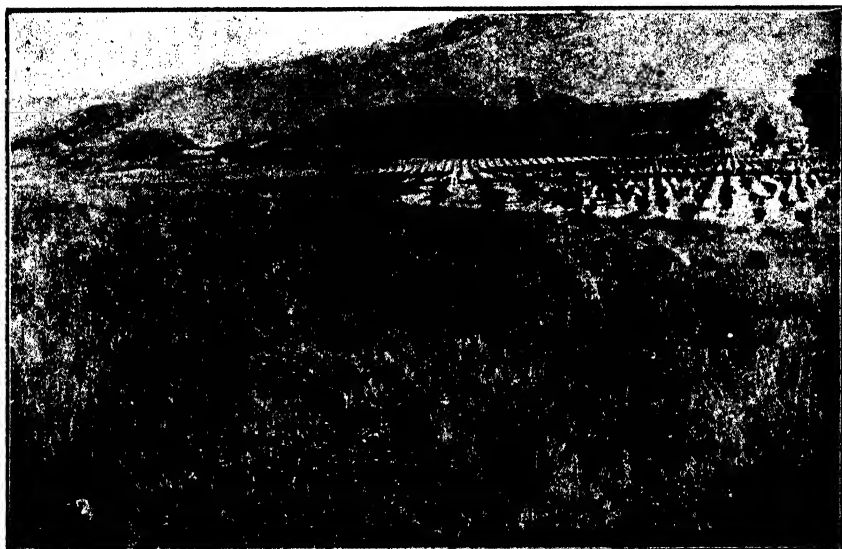


FIG. 11. PART OF SAME AREA AS IN FIG. 8, BUT ON FLATTISH GROUND FULLY EXPOSED TO THE SUN. .

Note the comparatively few tussocks, and the white clover in foreground.

[Photos W. D. Reid.]

11. The nature of the ground and its aspect makes a great difference to its chance of regeneration. Thus shady slopes are favourable for indigenous grasses, and sunny slopes unfavourable; so, too, is gravelly ground hostile to such settlement.

12. Extreme wind does not debar pasture from regenerating.

13. A considerable proportion of the regenerated pasture is palatable.

14. Most likely a good deal of regeneration arises from seeds being blown on to the enclosed area, though in many cases it arises from plants already on the ground.

15. The fescue-tussock—the dominant tussock of montane tussock-grassland—only appears in small quantity and spreads very slowly.

16. Except the New Zealand grasses already cited, hardly any others take a part in regeneration.

17. The New Zealand brooms—species of *Carmichaelia*—readily become abundant in areas free from rabbits, but in the first instance the plants arise from bushes which have been cropped to the ground.

18. The scabweed (*Raoulia lutescens*) and other species of that genus offer in their mats or cushions excellent seed-beds, and are a potent factor in regeneration. (This matter will be dealt with in a special article).

ROTATION OF CROPS.

A SYSTEM FOR DAIRY FARMS.

J. L. BRUCE, Superintendent of Experimental Farms.

IN the growing of more animal-feed, together with the keeping of a better class of stock, lies the main key to increased primary production in New Zealand, involving also closer settlement and better farming.

There is much land in this country admirably suited for a sound system of rotation farming, and upon which production could be easily doubled. The accompanying table shows a six-course rotation suitable for some of the dairying districts in the North Island. This system of rotation has been commenced at the Central Development Farm, Wera-roa, on a fairly extensive scale, and is also to be commenced on a smaller scale at the Ruakura Farm of Instruction and Moumahaki Experimental Farm, with slight variation to meet soil conditions and local requirements. On each of these farms those interested will in due course have an opportunity of seeing the system in practice.

It is not recommended that the whole area of any farm should be put under any rotation system. It is considered that from half to two-thirds of the total area of arable land will be best suited to meet requirements, the remainder of the holding being reserved for, say, a permanent lucerne stand, pig-paddocks, and a small area of maize for emergency purposes, &c. Maize, being of rapid growth and giving a heavy yield per acre, is considered a safe crop in case of early drought,

SIX-COURSE ROTATION FOR DAIRY FARMS.

Paddock No. 1 (12).	Paddock No. 2 (28).	Paddock No. 3 (10).	Paddock No. 4 (14).	Paddock No. 5 (16).	Paddock No. 6 (11).
1920. Grass. Plough in autumn for roots to follow.	1920. Roots. Plough in spring and sow in peas, barley, &c.	1920. Peas, Barley, Beans, Lin- seed, Potatoes, Rape, &c. Plough in autumn and sow in oats and tares	1920. Oats and Tares for Hay. Plough in autumn and sow out in grass.	1920. Grass. (Clover hay.)	1920. Grass.
1920-21. Roots. Plough in spring and sow in peas, barley, &c.	1920-21. Peas, Barley, Beans, Lin- seed, Potatoes, Rape, &c. Plough in autumn and sow in oats and tares.	1920-21. Oats and Tares for Hay. Plough in autumn and sow out in grass.	1920-21. Grass. (Clover hay.)	1920-21. Grass.	1920-21. Grass. Plough in autumn for roots to follow.
1921-22. Peas, Barley, Beans, Lin- seed, Potatoes, Rape, &c. Plough in autumn and sow in oats and tares.	1921-22. Oats and Tares for Hay. Plough in autumn and sow out in grass.	1921-22. Grass. (Clover hay.)	1921-22. Grass.	1921-22. Grass. Plough in autumn for roots to follow.	1921-22. Roots. Plough in spring and sow in peas, barley, &c.
1922-23. Oats and Tares for Hay. Plough in autumn and sow out in grass.	1922-23. Grass. (Clover hay.)	1922-23. Grass.	1922-23. Grass. Plough in autumn for roots to follow.	1922-23. Roots. Plough in spring and sow in peas, barley, &c.	1922-23. Peas, Barley, Beans, Lin- seed, Potatoes, Rape, &c. Plough in autumn and sow in oats and tares.
1923-24. Grass. (Clover hay.)	1923-24. Grass.	1923-24. Grass. Plough in autumn for roots to follow.	1923-24. Roots. Plough in spring and sow in peas, barley, &c.	1923-24. Peas, Barley, Beans, Lin- seed, Potatoes, Rape, &c. Plough in autumn and sow in oats and tares.	1923-24. Oats and Tares for Hay. Plough in autumn and sow out in grass.
1924-25. Grass.	1924-25. Grass. Plough in autumn for roots to follow.	1924-25. Roots. Plough in spring and sow in peas, barley, &c.	1924-25. Peas, Barley, Beans, Lin- seed, Potatoes, Rape, &c. Plough in autumn and sow in oats and tares.	1924-25. Oats and Tares for Hay. Plough in autumn and sow out in grass.	1924-25. Grass. (Clover hay.)

NOTE.—The actual paddock numbers at the Central Development Farm are shown in parentheses after the other numbers.

when it can be cut green for feed, thus saving both the fodder-hay and clover-hay crops for winter.

The tabulation of the Weraroa rotation system may be more easily followed and the benefits better understood by indicating its practical application on, say, a 50-acre holding, which acreage, as time goes on, will in all probability become quite an average-sized farm in the best dairying districts of this country, more especially in the North Island. Of the 50 acres, 30 acres—in six paddocks of 5 acres each—would be under a regular six-course rotation similar to the Weraroa scheme. Under favourable conditions the yields would probably be as stated in the following remarks:—Paddock 1: Two hundred to three hundred tons of roots. Paddock 2: One acre each of peas, barley, beans, and linseed, yielding, say, 30 to 40 bushels per acre, with 1 acre of potatoes. Rape is not essential in the rotation system on a small holding. These crops will ensure abundance of home-grown calf-feed, and also sufficient for finishing off pigs reared under the depasturing system, which will be dealt with in a subsequent article. On most small dairy farms worked on the rotation system a few good Romney ewes will be found very profitable and useful for cleaning-up purposes. Paddock 3: The oats and tares may be expected to yield from 15 to 20 tons of fodder hay. Paddock 4: First and second cut, possibly yielding 15 tons of hay. If the season is favourable the second crop may be allowed to seed, from which, at present prices for red clover, a handsome return may be obtained, and still leave the hay for stock-feeding purposes. Although the rotation system now advocated is by no means exhausting on the land if practised under good farming principles, it is recommended that in the late autumn, after the second crop of hay has been removed, the paddock should be top-dressed with a light dressing of manure, given a double harrowing with the tripod harrows, and closed up until the spring. Paddocks 5 and 6 are in pasture.

It may be observed that while the main object of this system is the increased production of dairy-produce, with ample provision for winter feed, which is so essential for profitable dairy-farming, some of the crops, particularly oats, vetches, and peas, are excellent smothering-crops for the eradication of weeds, which have become a serious scourge on much of the best arable land in dairying districts.

After providing for a homestead area, a lucerne stand (where the land is suitable), pig-paddocks, &c., already referred to, the remaining 20 acres will be required for pasture, which, if permanent, should be tripod-harrowed every autumn, with an occasional dressing with basic slag, or, if not available, bonedust or superphosphate, or both, according to the requirements of the soil.

It may be argued that rotation farming as here advocated is all very well in theory or for the Government to practise upon its farms, but that labour is unprocurable, and the small farmer cannot afford to employ assistance or keep horses for tillage. It will be observed, however, that of the six paddocks three are in grass, which means that on a 50-acre holding only about 15 acres are under cultivation at one time, and as practically every dairy-farmer has to keep one spring-cart horse it only involves keeping a second horse. A light two-horse team is ample for the working of a 50-acre dairy farm run on this system, or even a considerably larger area.

MILK-PRODUCTS IN AMERICA AND EUROPE.

A RECENT INVESTIGATION.

W. DEMPSTER, Dairy Division.

ACTING in accordance with departmental instructions, the writer left New Zealand for North America in June last, for the purpose of making inquiries into the manufacture and marketing of milk-powder, sugar of milk, and other branches of dairying as carried on in the United States and Canada. The range of the investigation was subsequently extended to Europe, the United Kingdom and certain parts of the Continent being visited.

Travelling by the same steamer from Wellington to San Francisco were the dairy-industry delegates from Taranaki, also the assistant secretary of the National Dairy Association, Mr. T. C. Brash, all of whom were on a somewhat similar errand to myself. Mr. Brash and I visited together a number of districts in America, where we jointly conferred with those in charge of factories or others who were concerned in matters pertaining to the dairy industry.

TRAVEL AND OBSERVATIONS IN THE UNITED STATES.

Shortly after our arrival at San Francisco we had an opportunity of attending a meeting of the Dairy Council of California, at which many interesting subjects in regard to dairying were discussed. The Council is a body of dairymen somewhat resembling that of our representative dairy associations in New Zealand. One subject dealt with was that of the assistance required on the farms for the milking of dairy herds, a question which appears to have been more acute in America than in New Zealand. Those engaged in the industry in California are more or less sceptical regarding the use of milking-machines, looking upon them as a somewhat doubtful proposition, and the releaser system, with all its attendant dangers from a sanitary point of view, is unknown in that locality. We were here introduced to many of the leading dairymen of the States, which subsequently proved to be helpful to us in prosecuting our inquiries in other parts of the country.

The opportunity was afforded us of visiting the Californian Central Cream Company's large works at Ferndale and Eukera, where we were supplied with full information regarding each product handled. The operations of this concern include the manufacture of skim-milk powder, butter, Swiss cheese, and sugar of milk, and are carried on upon a very extensive scale. The quality of the milk-powder, which is prepared by the Grey-Jensen spray system, is considered to be one of the best in the country, and finds a ready sale at remunerative prices. The bulk of the milk received by the company for drying is delivered to the factory or to skimming-stations by the farmers delivery being twice daily. The skim-milk from the skimming stations is conveyed to the drying-factory in cylindrical tanks attached

to motor-lorries, and is discharged from the tanks by compressed air. The whole milk is carefully tested for purity on the receiving-stages before being accepted for the manufacture of milk-powder. This test immediately indicates whether the milk has been properly cared for or not. An examination of a portion of the milk being received was made by me, and in my opinion the condition was of a high average standard, comparing more than favourably with much of the milk delivered to the factories in New Zealand. The price paid by the company at the time of our visit (autumn) was 2s. 11d. per pound of butterfat, together with an allowance for the skim-milk of 1s. 10½d. per 100 lb. The latter payment applied only to the supplies delivered to the drying-factory; a charge of 3½d. per 100 lb. was made for the carriage of the skim-milk if delivered to the stations only.

The next factory visited was that of the Associated Dairymen of California, at Sacramento, which was nearing completion and expected to commence operations at an early date. The process of drying milk adopted at this factory is also on the spray system, the intention being to concentrate the milk into a heated chamber prior to the spraying. Another large factory at Modesto was also visited. The scope of the association's business at this centre consists in the manufacture of butter, muriatic-acid casein, sugar of milk, and what is known as "jack" cheese from the milk standardized to 1.15 per cent. of butterfat. The milk-sugar plant at this factory was very similar to that used at the New Zealand Sugar of Milk and Casein Company's factory, at Edendale. Here we were freely shown the methods adopted in preparing the sugar of milk and other products.

At Modesto arrangements were made for us to see over the large milk-condensing establishment belonging to Borden's Ltd., which is situated close to this centre. The quantity of milk handled is 12,000 gallons per day. Both sweetened and unsweetened milk is prepared, and packed in 1 lb. and ½ lb. tins. Most of the output is sold in America, although efforts are being made to extend the export trade.

At Omaha we found that an important feature of the dairy industry was the manufacture of butter. So far as the methods adopted are concerned, we did not consider that these were in advance of the ordinary practice in New Zealand. It was noticed, however, that the buttermilk was dried and sold in powder form, two systems of drying being in vogue, one factory using the spray method and two others having heated-roller plants for this purpose. The powder prepared by the spray system was realizing 10d. per pound, and that made by means of the rollers 7d. to 7½d. per pound. In the former case buttermilk was being received from outside districts, where it had been condensed to 25 per cent. of its original volume, thus reducing the cost of transport and also curtailing the drying process at the central factory. In one instance we were struck with the economical use which was made of practically the whole of the heating-surface of the rollers. One large roller, about 4 ft. in diameter, was heated by steam and the milk distributed on its surface by means of a small roller, 10 in. in diameter, which was running in the body of the milk to be dried and in contact with the roller of larger size. The film of milk is in this way transferred to the heating-roller at a point almost immediately below that at which the dried film of milk leaves the heated surface.

At one of the butter-factories at Omaha we saw the operation of mixing milk-powder, butter, and water into a liquid representing a cream containing 25 per cent. of butterfat. The desired quantity of water is added to a jacketed vat, then the right proportion of skim-milk powder and butter is added, the butter having been previously tested for moisture-content. The vat is fitted with an appliance which resembles a ship's propeller on a small scale, and is revolved by mechanical power. The motion is regulated at a high speed until the powder is thoroughly incorporated with the water. The speed is then reduced, at which time the butter is added, and the temperature of the contents of the vat gradually raised to 145° F. It is held at this temperature for twenty to thirty minutes and then cooled to 135°, after which it is put through the homogenizer and immediately cooled to 45°.

Later we saw what is considered an improved method of reconstituting milk. The powder and water are mixed as previously described. The butter is first of all heated to a temperature of 120° and forced into the mixture of water and milk-powder by means of a special pump fitted with a spray nozzle. This spray of melted butter is introduced under the surface of the liquid, and is thereby evenly distributed throughout the mixture of water and powder.

I do not regard the reconstituting of milk as an important factor in the skim-milk-powder industry. Were the milk separated, the cream made into the finest butter, and the skim-milk made into the finest powder, then reconstituted the same day, I would not consider this reconstituted milk as good as the original milk. I have seen samples of reconstituted milk (not made for commercial purposes), very nice and sweet, and soured with a clean lactic-acid flavour, but this milk was made under conditions which could never be attained in daily practice. There is no known method of reconstituting milk whereby the cream can be made to rise as in ordinary fresh milk. It is, however, a simple matter to reconstitute milk to make it show the same analysis as new milk, and no difference can be detected until it is tasted. The object of reconstituting milk would be to tide over a period of shortage in the supply of fresh milk in towns. Where this has been tried the housewife has complained if more than 10 per cent. of the reconstituted milk has been added to the fresh milk. Again, the irregularities in flavour of the best-keeping butter after storage, combined with the irregularities in milk-powder, are such that an even-flavoured milk could not be maintained from day to day.

Our next call was at Minneapolis, where we met Dr. S. M. Dick, who has been instrumental in starting a company to manufacture dried milk, and has patented a process in the treatment. This consists in spraying the milk into two separate air-heated chambers. In the first one the milk is only partially dried, and the process is completed in the second chamber.

After visiting Madison and meeting Professors Woll, Sammis, and Weigel, by whom we were well received, we proceeded to Meston, at which place there is a large milk-drying factory. The works were being enlarged and certain improvements made whereby a larger quantity of milk can be handled. New heating-chambers have been introduced, which provide for the treatment of 9,000 gallons per day of twenty-four hours in each chamber. The walls have a thickness of 18 in.,

are thoroughly insulated, and are finished with an asbestos plaster on the inside. Only skim-milk is dried here, and it was ascertained that the yield of powder was 8.9 lb. per 100 lb. of milk dealt with, it being stated that 0.1 per cent. was lost in the process of evaporation. The point was stressed that milk for drying purposes should not contain more than 0.2 per cent. of acidity.

At Waukeshaw, where milk-condensing is carried on extensively, I was able to see over the factory, at which 14,000 gallons of milk were being received daily. A large portion of the finished product is exported. The coal-consumption at these works was stated to be 14 tons per day, some 140,000 gallons of water being also required daily. The milk is pasteurized, and held at a temperature of 140° in metal enamelled tanks while awaiting condensation. Tanks of this nature may be found an advantage in connection with our industry in New Zealand, and, in my opinion, would make excellent whey-tanks where this liquid is separated for buttermaking. The tanks are manufactured by the Ecyrta Enamelware Company, Ohio.

We arrived at Chicago at the end of July, and here we got in touch with several large firms which are connected with the milk-powder industry. While a considerable amount of information concerning the drying of milk was obtained, it was noticed that the method of treatment did not differ to any great extent from the practice at other factories visited. The opportunity was also taken while in Chicago to interview Arthur Harris and Co. and the Swenson Evaporating Company, both of whom are makers of vacuum-pans, condensing machinery, and other dairy appliances, particulars of which were noted for reference if required at a future date. The well-known firm of Swifts was also interviewed, and I was informed that this company controlled about 60 per cent. of the creamery butter produced in the country.

While visiting the stockyards at Chicago the marketing of veal calves came under my notice. Calves ranging from four to five weeks old were disposed of for slaughtering at from £3 10s. to £5, the weight being from 85 lb. to 110 lb. The same thing was seen at the cattle-yards in New York, where the prices were running from £3 to £4 12s. per head. I was informed that these calves were collected at the pig-receiving depots throughout the country and forwarded to the abattoirs. In view of these prices for veal and the fact that this meat was being sold in London and Glasgow at the time of my visit at 11½d. per pound, it would seem that some effort should be made to market the calves which are destroyed annually in New Zealand in such large numbers.

Alma and Detroit were then visited. At Alma I saw a special continuous condenser which has proved very successful in connection with the drying of milk. Condensers of this type are on the market for sale by the makers. The factory of the Detroit Creamery Company was visited, where a very large business in buttermaking is carried on. The company also manufactures some 5,000 gallons of ice-cream daily. A portion of the cream is frozen during the summer months in order to keep the ice-cream trade going at the time of scarcity during the off season.

My inquiries in regard to casein took me to Philadelphia, which is the headquarters of the Union Casein Company. This concern has a very large controlling interest in the marketing of casein, and was holding a stock of between 3,000,000 lb. and 4,000,000 lb. A shipment

of 100,000 lb. was just being made to Denmark at the price of 6½d. per pound f.o.b. I was told that a patent had been taken out for the preparation from casein of a paint made which will stand water and also remain fast in colour, and which may be put up for sale in any colour desired.

After spending several days in New York, during which time many of the firms interested in the marketing of dairy-produce were interviewed, I proceeded to Syracuse, which is the headquarters of the Merrell-Soule Company. This company is paying 12s. 6d. per 100 lb. for milk containing 3 per cent. of butterfat, and an additional 2d. for each tenth of a pound of butterfat above 3 per cent. The yield of milk-powder obtained by this concern is from 8.4 per cent. to 9 per cent.

Before leaving the United States for Canada a further number of milk-powder factories were visited.

INVESTIGATIONS IN CANADA.

With the exception of five factories owned by Canadian Milk Products, Ltd., whose head office is at Toronto, there has been no development of the milk-powder industry in Canada. The Canadian Milk Products seems to be a prosperous concern. The business is conducted with characteristic Canadian thoroughness, and on highly scientific principles. A bacteriologist is employed, and frequent tests are made at every stage in the process of manufacture. As showing the demand this company has for milk-powder, it may be stated that an order for an additional supply of 200 tons per month had to be refused. The system used is the Merrell-Soule spray method. The output of the company is skim-milk powder and butter only, and is a very large one. A portion is exported to Great Britain, and the remainder is sold in Canada or America.

Notwithstanding the enormous production of milk in the eastern provinces of Canada, it is rather significant that so comparatively little attention has yet been paid to the manufacture of milk-powder, for it must be conceded that the Canadians are by no means slow to take advantage of any change in the dairy industry which will bring in a higher return to themselves individually or prove more remunerative to the country in general. From inquiries made of the leading authorities on dairying, including Mr. J. A. Ruddick, Dairy and Cool Storage Commissioner of the Dominion, I gathered that in Canada the drying of milk is not looked upon as likely to supersede the ordinary uses of milk for the manufacture of cheese and butter. The opinions expressed to me in this connection indicate clearly that there is need for caution where a change from the present lines of dairying is contemplated. The danger of overproduction of milk-powder must not be overlooked, and those engaged in the dairy industry in Canada are by no means carried away by the high prices paid for milk for this purpose in the United States or any other country.

The production of milk-sugar has not yet been taken up in Canada, nor is it likely to be while the present state of the market for that product exists.

INQUIRIES MADE IN BRITAIN.

I left Canada for England in the middle of September. On arrival in London I began an investigation into the prospects of marketing milk-powder from New Zealand. At the outset I found that a number

of well-known importers of our dairy-produce were already devoting their attention to this matter, in anticipation of supplies of skim-milk powder reaching the London market from the Dominion in the near future. Several of these merchants informed me that they had arranged for one of their representatives to specially inquire into this particular trade, so as to be in readiness to place any consignments that may be received.

As will be seen in a later part of this report, large quantities of milk-powder are already marketed in Britain. In my interviews with both merchants and others who are in touch with the market all spoke hopefully of the prospects for the sale of skim-milk powder in England and Scotland, providing the supplies do not come forward in too great a volume or before the users, who are steadily increasing in number, find that this product is one which can be successfully handled in large quantities.

As regards the preparation of milk-powder in England there has been no material development, neither is there expected to be, on account of the demand for fresh milk for consumption in the towns and the prices ruling for cheese, butter, and other dairy-produce. The drying of milk has, however, been going on for some time at Wrenbury, near Crew. I called at this factory, which is owned by Tru Foods, Ltd. The system of drying the milk here is the Merrell-Soule, and exactly the same as that in operation at so many of the milk-powder factories in America. The powder turned out at Wrenbury is of excellent quality, and was being sold at 13½d. per pound at the factory-door during the time of my visit. The sale of all powdered milk imported into England produced by the Merrell-Soule method of drying is controlled by Tru Foods, Ltd.

Beyond a certain amount of experimenting the drying of milk has not been undertaken in Scotland. It is, however, carried on to some extent in Ireland.

VISIT TO HOLLAND.

Being aware that the milk-powder industry had been established in Holland some years ago, I decided to visit that country, and did so in company with the dairy-industry delegates from Taranaki, who were then in London. For reasons which need not be mentioned here the trip to Holland was, however, a hurried one. At The Hague we met the Minister of Agriculture, the director of the Butter Control Station, and other officials. We were given every opportunity of following up our mission, and were supplied with many particulars regarding the dairy industry in Holland, mention of which is made later on.

FACTORS IN THE PRODUCTION AND MARKETING OF MILK-POWDER.

The total production of milk-powder in the United States in 1918 was 25,626,000 lb. Of the total milk-powder produced, about 25 per cent. was from whole milk. The amount consumed in the States is estimated at 18,000,000 lb., or only 0.16 lb. per head of the population. Besides the quantity stated, peptonized, humanized, and sterilized milk-powders are manufactured, but I could get no figures showing the amount.

The United Kingdom imported, in 1918, 9,977,408 lb. of milk-powder, and manufactured 1,121,790 lb., making a total of 11,099,198 lb. con-

sumed in the country—equal to 0.27 lb. per head. The principal exporting countries were the United States, 61,210 cwt.; Netherlands, 20,105 cwt.; Canada, 5,908 cwt.; Victoria, 602 cwt.; other British possessions, 1,259 cwt. Sweden, Denmark, Germany, France, and other foreign countries, which exported a total of 11,562 cwt. in 1914, had not sent any into England since that year. In addition to milk-powder the United Kingdom imported 5,600,000 lb. of dried milk under the heading of "impoverished, humanized, peptonized, and sterilized milk." This milk is principally invalids' and infants' food, and works out at 0.14 lb. per head. New Zealand, with 38,335 cwt. (Glaxo), heads the list, the United States (6,205 cwt.), Australia (3,832 cwt.), and foreign countries (581 cwt.) being the other exporters. The total milk-powder imported, including the infants' and invalids' product, works out at 0.41 lb. per head, which, when compared with either butter or cheese consumption, is very small. Neither in England nor America did I find any wholesale stock of milk-powder, this indicating that available supplies were in the hands of the actual users.

I saw milk being dried on eight different makes of rollers, and under eight different systems of spraying. I do not think that the owner of any system would claim that it was perfection under all the different existing conditions. The quality of the raw milk causes about as much variation in the quality of powder as do the different systems of drying. It has to be borne in mind that a fault in the milk, either in overacidity or in flavour, is greatly multiplied in the finished powder. The milk-powder business, at both the manufacturing and marketing ends, is in more or less an experimental stage. Were it possible for all manufacturers to have the milk dried and packed into tins two hours after milking probably 50 per cent. of the trouble now arising would be obviated. I have seen both good and bad samples of skim-milk and whole-milk powder made under the same process, with solubility and flavour so different as to lead one to believe that the process must have differed. The difference in quality was due, however, to the variation in raw material. The processes of cheese and butter manufacture can be varied more than the process of drying milk, consequently the difference in raw material from day to day causes a greater variation in the quality of powder than it does in the quality of either butter or cheese.

The keeping-quality of whole-milk powder, no matter under what process it is manufactured, cannot be regarded as satisfactory. The best whole-milk powder I saw was contained in sealed tins and kept at a temperature corresponding to that at which butter is stored. This increased the cost of production, or handling, but it is too risky to do otherwise. The daily output of any whole-milk-powder factory is not sufficiently uniform to warrant the housewife securing a daily supply at any country store, where the age of the powder may be indefinite. The Merrell-Soule Company, of Syracuse, are the only people I have met who are making experiments with the keeping of whole-milk powder for a definite period in cold storage. They have confined themselves hitherto to fulfilling special orders for whole milk which they knew was not required to keep indefinitely. They are now conducting experiments by storing in barrels and tins. The barrels contain 160 lb., with double paper lining (the linings are strong, almost like thin leather); the tins, containing 50 lb., are square-shaped with round hole in centre,

and the cover is sealed with paraffin. The packages are kept in a dry atmosphere, with a temperature of 0° to 8° below zero F.

Having given due consideration to the different processes of manufacture, and knowing that the principles underlying the manufacture of milk-powder will have to be modified and adjusted to suit our New Zealand conditions, I feel confident that we can and shall evolve our own process. Our butter and cheese industry was started on general principles, and we have evolved what suits our conditions. We shall no doubt do likewise with milk-powder.

Should any factory decide to manufacture milk-powder on the roller system, there are different types of rollers to be bought, just as there are different kinds of separators. The makers of different rollers may be constrained from using certain patents that another roller-manufacturer has protected, but that would affect us no more than the patents which protect one separator-manufacturer from having his separator copied by another. There is no need to pay royalty. The manufacturer of the rollers is only looking for the trade in rollers.

When drying milk with what is known as the spray process the system of manufacture is to condense to a 3 or 4 to 1 consistency, either by vacuum-pan or what is known as a continuous condenser. There are numerous makes of pans and condensers on the market, which can be bought the same as any other dairy machinery. There are different methods of spraying into a chamber. Some use one kind of nozzle and some another, but, as long as a particular nozzle which is covered by patents is not used, any one can spray milk freely. There is in general no more restriction on spraying milk than there is on spraying water. A chamber of any size or shape can be built without restriction, while hot or cold air can be taken in or out as desired. There is no need to pay royalty in the manufacture of milk under any spray process, providing a nozzle which is protected by patent is not used.

That the demand for milk-powder exceeds present production is certain, but how much further production can be increased without exceeding demand is hard to gauge. When the milk-powder industry started in America this phase of the business was considered, and only buildings of a temporary nature were erected. Now that the milk-powder business is more firmly established more permanent buildings are being erected, so that the erection of temporary buildings is not to be recommended. If it came to the survival of the fittest New Zealand would be one of those countries to survive, provided the quality of the powder was equal to that of other countries. There is every reason to believe that our powder should be equal to, if not better than, any produced, as our cows are mostly grass-fed and our pastures good. If we do not succeed it will be because the manufacturer or farmer has failed to carry out the good work which the cows begin. We can produce milk more cheaply than any country, thanks to our climate, rainfall, and the milking-machine. We have less money invested in land and buildings per cow than any country visited. In the western States of America dairying takes £105 to £110 worth of land per cow, the middle west £110 to £120, and the eastern States £120 to £130. In Holland the amount is about £300 per cow. In New Zealand our cows are much lower in money value than in the countries referred to. These facts bear weight when considering the future development

of dairying, as a dairy-farmer can start in New Zealand with less capital than in almost any country supplying the world market.

I could get very little reliable data regarding the cost of manufacture of milk-powder. Most of the manufacturers are proprietary concerns, and the matter of cost touches on private affairs. The cost, however, is somewhere in the vicinity of 3d. to 3½d. per pound of finished powder. I found the cost of manufacture of butter to be much the same, but, if anything, higher than it is in New Zealand. Coal is a very expensive item, and will be one of the deciding factors for a company contemplating the erection of a milk-powder factory, the quantity required for a 3,000-cow factory being between 5 and 6 tons per day. Without a guaranteed coal-supply, or equivalent supply of electric power for heating, it would be useless to contemplate making milk-powder.

To manufacture milk-powder of the finest quality it is necessary to have the milk delivered both morning and evening; therefore two shifts of men are required at the factory.

The minimum number of cows required is 3,000, giving a daily supply of from 9,000 to 10,000 gallons. The necessary buildings would cost approximately £15,000 if erected in concrete, and could be made to cost more. Manager's house and accommodation for eighteen to twenty men would also have to be allowed for. The corresponding plant, which would include separators (but no other buttermaking machinery), would cost from £15,000 to £18,000. To establish condensing-stations to work in conjunction with a central drying-factory would not lessen the cost, as practically all the machinery at a condensing-station would be identical with that at the central factory, if an equal supply were received. The central factory would require to make additional chambers for finishing the powder, so that the only saving might be in the carting of the material to the condensing-station. The fuel required at a condensing-station would be fully four-fifths of that required during the whole process, so that one-fifth of the coal-cartage could be avoided; but in carting the concentrated milk there would be 25 lb. to 30 lb., against 9 lb. of the powder. This difference would more than compensate for the difference in coal and crate cartage, &c. I could not get much information regarding the effect on quality of carting the concentrate, but it is certain that it does not improve it. Therefore at the present juncture the erection of condensing-stations is not to be recommended.

When in Holland I noticed parchment-lined wooden packages containing 100 lb. of powder, which I regarded as a satisfactory container. I saw some of the same packages landed in England, however, and fully 25 per cent. of them were damaged, two packages were entirely empty, while others were partly empty. I also saw square tins containing 56 lb., not crated, so knocked about as to resemble a dump for empty tins. I regard sealed tins, two in a crate, as being the only satisfactory package, especially as our export milk-powder has to go through the tropics. Continuity of supply will be an important factor in creating a demand for milk-powder, and if properly packed in sealed tins the powder can be stored to suit the market.

Whole-milk powder is used principally in the manufacture of chocolate and high-class confectionery, and generally goes straight from the milk-powder factory to fulfil special orders. Skim-milk powder is

also used by confectioners, chocolate-makers, and bakers. Further, it is used largely in the manufacture of margarine. A considerable quantity is also used in the ice-cream business in America. It is estimated by brokers in the trade in England that so far not more than 3 per cent. of the bakers are using skim-milk powder. No old customers are being lost, while new ones are being gained. The demand will be from margarine-manufacturers, bakers, and confectionery-makers. If sufficiently advertised it will also be used in every country where bread is baked.

What the trade requires is a soluble powder with good flavour; if soluble in cold water, so much the better. On 11th November last the London quotations for skim-milk powder were as follows:—Netherlands, 115s.: other brands—soluble in hot water, up to 129s.; soluble in cold water, 150s. Netherlands powder is made on the roller system and is not so soluble; it contains a higher percentage of acidity, and the flavour is not so clean. The position New Zealand milk-powder may occupy on the world's markets depends greatly on the care of the milk on the farm.

As regards the future of milk-powder, while satisfied that the present supply to the British market does not meet the demand, I would recommend our New Zealand dairy companies in suitable localities, before undertaking the manufacture of milk-powder, to watch the effect which the additional 3,000 tons from the Dominion, the manufacture of which has already been arranged for, will have on the market. Such increase from New Zealand (with a further large increase to follow) will, in my opinion, be too much for the British market to absorb in one year. The securing of men skilled in the manufacture of milk-powder is another important point; in fact, so vital that caution is to be recommended even were it certain that no country but New Zealand was contemplating immediate extension of the industry. The statistical and general position of milk and milk-products throughout the world, in its bearing on the milk-powder question, may be discussed in greater detail in a supplementary report.

SUGAR OF MILK.

The production of milk-sugar in America has been carried on for a great many years, and has passed through various periods of successful operation and depression of the trade. Prior to the war the industry was in a somewhat precarious condition, owing to the large accumulation of stocks. Shortly after the war began the demand for milk-sugar from America increased, and this had the effect of enabling the manufacturers to carry on. In 1918 the demand for milk-sugar in England greatly increased, and the importations from America were far in excess of any previous year. I was informed that 10,000,000 lb. of milk-sugar was exported to Great Britain during the war period, and that 85 per cent. of this amount was delivered in 1918, which had the effect of clearing the accumulated stocks in America. It is understood that the greater portion of this sugar of milk was used for making smoke-shells. In normal times the consumption of milk-sugar in Britain varied from 300 to 500 tons per annum, and was used almost solely in the manufacture of foods for infants and invalids.

When travelling through the United States I found that stocks of milk-sugar had again increased, and that the market was greatly congested. On leaving England a somewhat similar state of things existed as regards this product, and a few sales only were being effected.

It is estimated that 90 per cent. of those who started manufacturing milk-sugar in America have suffered a financial loss thereby. One prominent sugar-manufacturer admitted to me that he kept his factory running at a loss for two years, and only made it a success by securing the services of his rival's best man. It is estimated that milk-sugar costs 6d. per pound to manufacture. Considering the capital to be invested and the amount of labour and coal required—six men and 6 tons of coal to 1 ton of sugar daily—it would seem that from an economic point of view we could invest money more profitably and use our coal and employ our labour to better advantage. In Holland during my visit the only milk-sugar factory that had been working continually since before the war was closed because coal could be used more advantageously in other industries. Apart from milk-sugar used for war purposes there is comparatively little market. The factory buildings in the United States are of a very temporary nature, and are now written off; so that were we to go extensively into the sugar-of-milk business we would be paying interest and depreciation, while our American competitors' plant was paid up; we should also have to ship our product farther. We have no natural advantages, as their whey costs no more than ours. That there is an overproduction of milk-sugar in peace-time is certain, and any one starting the business at the present time is practically taking a chance that another war may arise.

CONDENSED MILK.

From June, 1918, to June, 1919, the quantity of condensed milk used in England was 633,000,000 lb. The scarcity of butter has created a demand for sweetened condensed milk, miners and other workmen using the milk spread on bread. The amount of condensed milk, sweetened and unsweetened, made in the United States in that period was over 2,000,000,000 lb., of which 728,740,509 lb. was exported. In 1913 the export was only 250,000 lb.

The growth of the condensed-milk business has been very rapid. It is considered by those interested that there is a great future for this product in European countries. The United States is making efforts to capture the trade. Unfortunately, a great quantity of inferior-quality milk from the different exporting countries has been dumped on the market, one shipment I heard of being so bad as to have 75 per cent. of blown tins. This has been chiefly due to the lack of experienced men, as training could not keep pace with the growth of the business. In the United States condensed milk requires to conform to a fairly high standard of fat and solids not fat, but in Britain the standard is lower, so that any milk which will not pass the United States standard finds its way to the United Kingdom.

Quite a lot of condensed milk is put into barrels containing 100 lb. In the year ended June, 1919, Britain used 9,000,000 lb. of bulk condensed milk, and quite a lot is sold throughout the United States. This milk is being used in the manufacture of milk-chocolate, and in

the ice-cream business; also in the manufacture of confectionery, in which it is coming into competition with milk-powder. In the chocolate business condensed milk has the advantage that it is semi-liquid and sweet, and, provided it is cheap enough, the analysis does not matter. In the ice-cream business milk-powder is gaining ground because condensed milk requires to be tested for fat and solids not fat; and it is also necessary to use the whole barrel immediately it is opened. Milk-powder has not been long enough in use for one to definitely say that it will replace condensed milk in the ice-cream business. In the confectionery business there is no doubt that milk-powder is fast replacing condensed milk, as it is more convenient to handle and can be used in any desired quantity. I do not think that condensed milk is holding its own used as infants' or invalids' food, but I think it will be a long time before it is replaced by milk-powder for domestic purposes. Milk-powder is being principally sold in bulk, and has not reached the stage when a packet may be bought from any grocer.

CASEIN.

The Americans look upon the manufacture of casein as something to be done with skim-milk when there is no better outlet, and sum up the situation thus: One hundred pounds of skim-milk, when fed to pigs, will produce 3 lb. of live-weight pork, while the same quantity of milk will produce 3 lb. of casein, and $\frac{1}{2}$ lb. of live-weight pork if the whey from the casein is fed to pigs. If, then, the price of $2\frac{1}{2}$ lb. of live-weight pork is worth more than 3 lb. of casein it does not pay to manufacture this product. Further, the disposal of casein is regarded as impoverishing the soil on the farm, while the keeping of pigs has the opposite effect.

Some of the authorities consulted claim that skim-milk and butter-milk have too much value as a human food to be fed to animals or to be made into casein. They contend that 100 lb. of skim-milk when dried will produce 9 lb. of human food, so that 9 lb. of human food are used in producing 3 lb. of live-weight pork. The difference between live-weight and dead-weight reduced this to 2 lb. It is therefore a matter of the relative value as between skim-milk powder, pork, and casein—which article it will pay the farmer best to produce.

In view of the shortage of foodstuffs for human consumption throughout the world at the present time the question of producing the greatest quantity both from a commercial and economical point of view is, of course, worthy of consideration. It may be noted that there is at the present time a world shortage of pigs. The number in England has decreased from 3,900,000 in 1914 to 2,800,000 in 1918—a reduction of 30 per cent. The position in England in this respect is accentuated on the Continent, and in some countries the decrease in pigs is no less than 50 per cent. It will thus be seen that the price of pork is likely to remain at a high figure for some considerable time, and on that account it may be more profitable to feed the skim-milk and buttermilk to pigs rather than manufacture casein.

One factory was visited where the buttermilk was being concentrated and mixed with other foods and then fed to chickens. It was demonstrated that these chickens gained an average weight of 2 lb. in ten days, being then killed for the market. The firm interested in this product assured me that buttermilk had become so valuable as a

human food that they were considering the question of drying it for sale to bread-manufacturers.

I visited several factories in the United States where buttermilk was being dealt with in this manner, the powder being sold for 5d. to 7½d. per pound. It should be remembered that the greater portion of the buttermilk handled at the butter-factories in New Zealand would not be suitable as a human food if made into powder, owing to the fact that large quantities of bicarbonate of soda are used in neutralizing the high acidity of the cream which is produced under the home separation system. Then, again, the dairy factories in the Dominion which are at present manufacturing casein from skim-milk cannot expect to turn this material into a powder for human food on a small scale, as the quantity of skim-milk available at any one factory is not sufficient to warrant the provision of a drying plant.

Despite the views held by the Americans regarding the production of casein as compared with other products, and notwithstanding the fact that the dairy herds of France have been depleted by about two millions as the result of the war, France is still practically supplying the whole demand for rennet casein used in England, which is estimated at 1,000 tons per annum. Moreover, rennet casein is in great demand in Germany for the manufacture of combs, buttons, ladies' hairpins, toys, imitation ebony and ivory, cigar and cigarette holders, rings, water-tap handles, knife-handles, &c. It may be mentioned here that lactic-acid casein has been tried when rennet casein was unprocureable, but it was found unsatisfactory for the manufacture of the articles mentioned. Owing to lactic-acid casein being more soluble it is used in the manufacture of paints and glues, and to a very large extent for the facing of paper. It is estimated that 85 per cent. of the output of lactic-acid casein is used for the latter purpose. On that account greater quantities of this casein are required on the world's market than of that made by the use of rennet.

As the result of my inquiries I found that extensive stocks of casein were held in the United States; also that considerable quantities of lactic-acid casein were still in the sellers' hands in England, the greater demand in this case being for rennet casein. The world's demand for casein at the present time is estimated at 20,000,000 lb. yearly. Towards this quantity the United States produced 8,600,000 lb. during 1918. The indications are that there is a growing demand for casein.

Teachers' Farm-school at Ruakura.—A third annual school for teachers at Ruakura Farm of Instruction, organized by the Auckland Education Board in co-operation with the Department of Agriculture, was held from 26th to 31st January, some seventy teachers taking part. The school was divided into three sections—a men's class, a women's class, and a special dairy course. Many of the lectures and demonstrations were coincident—covering two or three sections—but the general arrangement gave the school elasticity, with opportunity for specialization. A very useful course was given by specialists of the Department of Agriculture, agricultural instructors of the Board of Education, and other educationists. The school was favoured with very fine weather, enabling most lectures to be given in the open air and facilitating close touch with the various activities of the farm.

THE FRUIT INDUSTRY OF NORTH AMERICA.

POINTS IN APPLE-CULTURE AND ORCHARD PRACTICE.

J. A. CAMPBELL, Assistant Director of the Horticulture Division.

APPLE-PRODUCTION in the United States and Canada presents many interesting features, particularly when considered in comparison with conditions and methods in New Zealand.

Apples are grown extensively in the east and west of both countries, though the conditions and results obtained are very dissimilar. In the principal apple-growing districts in the west the summer weather is dry, hot, and clear; consequently fungus diseases are not very troublesome. In the east there is more rain during the summer months, and therefore, although considerably hotter and more humid in many parts, the climatic conditions obtaining in this area more closely resemble those in New Zealand.

EASTERN FEATURES.

New York State is held to be the largest apple-producing State in the Union, while Nova Scotia possibly produces more apples than any other province in Canada. In each of the areas mentioned fruit-growing is operated on much the same plan. The trees are mainly large, and comprise some of the oldest to be found on the continent. Many of them are reputed to be seventy, eighty, and up to a hundred years of age. Forty of these trees go to the acre. Clean cultivation is not generally practised, neither is pruning nor thinning of the fruit. Owing to this, although heavy crops are occasionally secured, it will be well understood that such crops are not produced annually by the same trees. Black-spot and other fungus diseases are very prevalent, and, owing to the size and density of the trees, efficient spraying is an extremely difficult matter. Consequently black-spot in particular takes a heavy toll of the fruit crop annually. In Nova Scotia spraying practices are very similar to those followed in New Zealand, although there is a very decided tendency to drop lime-sulphur for summer use, substituting bordeaux mixture of 2-10-40 formula.

In quality the eastern apple compares favourably with anything produced in the country, but falls considerably short of the western apple in colour and general appearance. Owing to conditions under which they are grown, a large percentage of the eastern fruits are of necessity included in the lower grades or disposed of to by-product works.

CONDITIONS IN THE WEST.

In the west, as previously intimated, the conditions are entirely different. The principal apple-producing districts are all within the northern portion of what is termed the dry belt. The dry belt commences well up in British Columbia and extends to Washington, Oregon, and throughout California. The industry throughout this area is

much younger than in the east, and is conducted on much more methodical lines.

Irrigation is, of course, essential, and many object-lessons on the value of irrigation are to be found. That portion of Washington State within the dry belt and outside the irrigated areas is practically a desert, given over to sage-bush, sage-rats, and intermixed with sparse clumps of bunch-grass. This condition is to be found right up to the brink of the outer irrigation channel, while the opposite side presents a most beautiful rural picture. Viewing an orchard scene within the irrigated area, one is particularly struck by the health, size, and uniformity of the trees, the beautiful green of the alfalfa or lucerne,



ESOPUS SPITZENBERG TREE, FOURTEEN YEARS OLD.
HOOD RIVER, OREGON.

which is generally used as a permanent cover-crop, and also by the complete absence of fences, which do not exist even along the roadsides. Fruit is mainly grown in the valleys, the soil of which is deep and somewhat coarse, being composed of decayed rock brought down from the surrounding hills by the action of snow and ice in past ages.

All apple-trees are grown on the seedling stock. Pruning, as we understand it, is not practised. Young trees are lightly pruned in the first two years, resulting in the formation of four or five main branches. These are left to form the tree. Practically all subsequent growths remain untouched, other than a certain amount of thinning to prevent overcrowding. All side branches and laterals are left intact, and on these heavy crops of fruit are borne.

The principal varieties of apples grown in the north-west are Rymer's Golden, Jonathan, Delicious, Esopus Spitzenberg, Yellow Newtown, and American Winesap. These fruits generally attain a very high standard of colour, and, contrary to what one might expect, are uncommonly free of branch injury.

Six hundred packed boxes of apples per acre is considered to be a fair average yield from mature trees, but 1,000 to 1,500 boxes per acre have been obtained. Growers and others connected with the industry in the north-west attribute the high colour of their fruit to the frosty nights which obtain some time prior to the picking of the fruit.

Judging by the complete absence of shelter-belts orchards throughout the areas referred to have little to fear from high winds, although I saw several instances of wind-damage, illustrated by trees leaning away from the windy quarter in many of the outlying parts of these orchard areas. As a matter of fact, the absence of shelter-belts or any form of orchard-shelter is a noticeable factor throughout the whole of the American fruit areas visited.

Clean cultivation is carried out to some extent in the western orchards, but the common practice is to sow the area with lucerne after the trees have made sufficient progress, after which cultivation is discontinued other than a thorough disking of the area in the early spring. A later method, and one which is growing in popularity in connection with the treatment of the permanent lucerne cover-crop, is to dispense with the disking, leaving the lucerne to grow up each season and die down in the winter with no interference at all.

Adverting to the general appearance of the average north-west orchard, I must again refer to the uniformity in growth of the trees. Trees grow very much faster in these areas than is generally the case in New Zealand. It is not an uncommon thing to see a variety, such as Jonathan, Delicious, or Newtown Pippin, at seven years old half as large again, and in some cases almost twice as large, as a tree of similar age here. In considering the whole question of growth and production one has to take into account the factors of depth and nature of soil, continuous hot summer weather, water by means of irrigation when required, and stock.

THE QUESTION OF TREE-STOCK.

Although I found some difficulty to warrant my separating the factor of stock from the others, I am still strongly of the opinion that the seedling stock is largely responsible for the superior growth referred to, and succeeded in obtaining some fairly reliable information in support of this view. A case in point is the Deufar orchard, some 4,000 acres in extent, situated within the dry belt in the State of Oregon. This orchard is made up of apple varieties commonly grown in New Zealand, and grown very largely under similar conditions, with the one exception that they are worked on the seedling stock. All these trees showed the same superiority of growth as those grown in the irrigated areas. The seedling is the stock used almost entirely throughout the United States and Canada, and I am quite convinced that, grown under their conditions, it results in a stronger tree.

Seedling stocks are, of course, liable to attacks of woolly aphis, a fact which New Zealand and Australia learnt to their cost many

years ago. It was owing to the ravages of this disease that the Northern Spy stock was adopted. Woolly aphid affects the roots of the American trees to some extent, but it must be remembered that the severity of the average American winter has no doubt a detrimental effect on the progress of this insect pest. On the other hand, under the mild conditions in this country woolly aphid thrives abundantly, and on this account the use of the seedling stock is precluded.

My reason for particularly mentioning the use of the seedling stock in America, and the apparent advantages gained, is not with the idea that this country should adopt a similar stock, but mainly to emphasize the fact that the growth of an orchard is very largely dependent upon the class of stock on which the trees are worked, and, further, to bring under the notice of those in the industry the possible advantages to be gained by a systematic search for a stock more suitable for our requirements than the Northern Spy. Nurserymen in the past adopted the Northern Spy stock in the interests of the fruitgrower. This stock may still prove on investigation to be the best all-round stock for our purposes, but such should not be taken for granted. There are many other blight-proof varieties of apples which may possess characteristics superior to that of the Spy.

It may be added that investigations along these lines are being carried out at our Tauranga and Arataki Horticultural Stations, but, no doubt, valuable assistance in this direction, which might ultimately result very beneficially to the fruit industry, could be given by growers and nurserymen.

NOTE.—The subjects of co-operation and standardization were dealt with in last month's *Journal*.

Haymaking in the South.—In a recent report Mr. R. P. Connell, Instructor in Agriculture, Dunedin, observes, "In view of the comparatively long and severe winters experienced in Otago and Southland one cannot but remark on the insignificant amount of hay which is saved by the farmers generally in this area. One is told that hay-making is unpopular because of the risk arising from the variable weather. If this is the case ensilage-making should be more generally practised, but the success of the few farmers who do attempt hay-making seems to point to the fact that farmers may profitably undertake haymaking much more extensively than obtains at present.

Pasturing Pigs on Lucerne.—Grazing lucerne with pigs has been shown to be a very satisfactory method of utilizing that crop, and one of the cheapest ways of producing pork. An acre of good lucerne pasture, if supplemented with a 2-per-cent. ration of maize or barley, will support six to eight sows and fifty to seventy suckling-pigs for a period of about sixty days in early summer. During this time the pigs should gain 25 lb. to 30 lb. each. The same area (1 acre) supplemented in a similar way, has an average pig-carrying capacity of about 2,500 lb. of live-weight for the growing season. Farmers wishing to increase their pig stocks on small areas should take special note of this.—K. W. Gorringe, Instructor in Swine Husbandry.

CONCRETE WATER-TANKS.

CONCRETE tanks for holding water may be built in a variety of ways, either round or square, and underground or above ground. If the ground consists of solid material, such as rock, the cheapest method is to excavate a square chamber of the desired capacity, and to plaster or otherwise coat the inside to render it watertight. If the rock is "papa" it should be watertight without treatment. In fact, it is always worth while to make a trial without inside treatment, and if the tank leaks, then take steps accordingly. If the rock is much broken and irregular it will be easier to cover the floor with a few inches of fine and fairly rich concrete, sufficient to even up the irregularities and make a regular fall to the scour-outlet. Then set up timbering inside as close as practicable to the rock and fill in with similar concrete. The side thickness should not be less than 4 in., else it is difficult to make a good job. Tanks may be excavated in unyielding material other than rock, such as tight gravel, and made watertight as previously indicated, but there is always the risk of slight yielding of the earth causing cracks in the concrete, with attendant leaks, which are hard to stop.

If the ground is unsuitable for an underground tank of the unreinforced type described, the best solution is a circular tank standing above ground and reinforced principally with circumferential rods proportioned according to the diameter and depth of the tank proposed. It is also advisable to reinforce the bottom, which should be placed a foot or two below the surface to ensure the best bearing obtainable. Differential settlement of the ground under the weight of the tank and water may occur, and would wreck the tank if it were not properly designed and reinforced. The conditions of each location vary so much that no hard-and-fast rule can be laid down. The erection of reinforced tanks should not be attempted without expert advice and a proper plan. The importance of a scour-valve in all cases should not be overlooked, as it will save a great deal of trouble in cleaning out in the future. It should be of ample size, with the bottom of the tank graded to fall towards it from all points. With underground tanks the scour-outlet can be arranged by having the excavation on a hillside or bank.

A square underground tank to hold, say, 4,000 gallons should be 10 ft. by 10 ft. by 6 ft. 6 in. deep (net). If made too deep it is difficult to get the excavated material out. It could be made 12 ft. by 12 ft. by 5 ft., but the shallower the water the warmer it would get, and if roofed over the cost of the roof would be about 40 per cent. greater. If a circular raised tank is built its proportions will depend on whether it is to be roofed or not. If roofed it should be 9 ft. 6 in. in diameter by 9 ft. 6 in. deep.—*Public Works Department.*

MEASUREMENT OF STACKS TO FIND WEIGHT OF CONTENTS.

A. MACPHERSON, Fields Instructor, Christchurch

THE weight of a stack may be closely determined by measuring to ascertain the number of cubic feet or yards, and obtaining the weight per cubic foot by actual weighing. The number of yards per ton will depend on the solidity of settlement of the stack. Following is the hay and straw weight table:—

36 lb. avoirdupois of straw equals 1 truss.
 56 lb. avoirdupois of hay (old) equals 1 truss.
 60 lb. avoirdupois of hay (new) equals 1 truss.
 36 trusses equals 1 load.

In Britain hay is called "old" after the commencement of September, when it has had time to settle and get thoroughly dry. Allowing more margin, however, it would be safe to assume that hay could be considered as old after being six months in the stack. A load of old hay should weigh about 18 cwt., a load of new hay about 19 cwt. 32 lb.

The weight of hay per cubic yard in the stack depends on the nature of the hay, its age, the size of the stack, and the part of the stack taken. It varies from 112 lb. to 300 lb. per cubic yard. For different conditions of hay and stacks the number of cubic yards to a ton will approximately vary as follows:—

Condition of Stack.			Oblong or Square Stacks, Cubic Yards.	Round Stacks, Cubic Yards.
Not well settled	..	..	12	13
Fairly settled	..	..	10	11
Very compact	..	..	8	9

Second-cut clover hay will require 13 or 14 cubic yards to a ton.

The weight may be ascertained very accurately by actually measuring the cubic contents of a truss, and from this calculating the weight of a cubic foot. The following shows the number of cubic yards in a ton at different weights per foot:—

Weight per Foot. lb.			Yards to a Ton	Weight per Foot. lb.			Yards to a Ton.
4.18	..	..	20	6.37	..	..	13
4.36	..	..	19	6.87	..	..	12
4.60	..	..	18	7.50	..	..	11
4.88	..	..	17	8.25	..	..	10
5.18	..	..	16	9.18	..	..	9
5.53	..	..	15	10.31	..	..	8
6.00	..	..	14	11.85	..	..	7

For calculating the contents of oblong or square haystacks (Fig. 1) take the length and breadth of the stack in feet and inches half-way between the upper part of the stack-bed and the eaves, A to B and B to C, an allowance (from 3 in. in trimmed stacks to 8 in. in others) being made in each measurement for the loose outsides; then take the height from the upper part of the stack-bed to the eaves, D to E.

For stacks with gable ends take one-third of the perpendicular height of roof E to F.

For stacks with hipped ends take one-fifth of perpendicular height of roof.

Example with Fig. 1.

Breadth of stack (A to B)	.. .. .	25 ft.
Length of stack (B to C)	.. .. .	50 ft.
Height from upper part of stack-bed to eave (D to E)	.. .. .	12 ft.
One-third of height from eaves to ridge (E to F) (9 ft.)	.. .. .	3 ft.
Total average height of stack	.. .. .	15 ft.

Contents of stack = length \times breadth \times total average height :—

$$\begin{array}{r}
 25 \\
 \times 50 \\
 \hline
 1250 \\
 \times 15 \\
 \hline
 6250 \\
 \times 1250 \\
 \hline
 2718750 \text{ cub. ft.}
 \end{array}$$

694.4 cub. yd. = contents of stack.

Having a stack fairly well settled, and weight per cubic foot 8.25 lb., this would give, according to table, 10 cubic yards to the ton. Therefore weight of hay in stack is $694.4 \div 10 = 69.44$ tons.

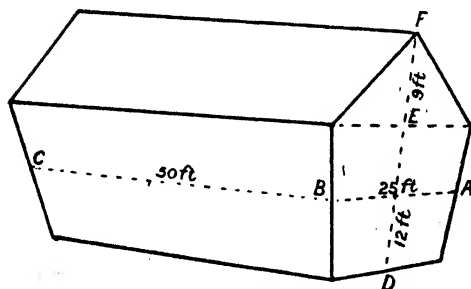


FIG. 1. OBLONG OR SQUARE STACK.

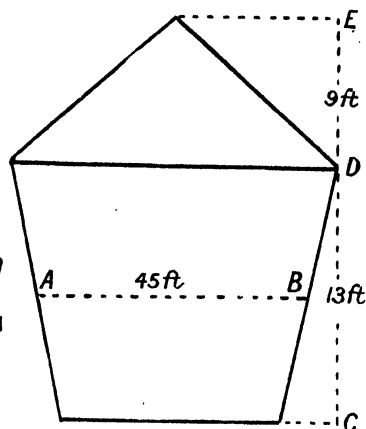


FIG. 2. ROUND STACK.

To determine the number of cubic feet contained in a round stack with a conical top (Fig. 2) the average girth must be measured at AB. The mean or average height is ascertained by taking the perpendicular height from the base of the stack to the eaves CD and adding to it one-third of the perpendicular height from the eaves to top DE.

Multiply the average girth, 45 ft., by itself :—

$$\begin{array}{r}
 45 \\
 \times 45 \\
 \hline
 225 \\
 \times 180 \\
 \hline
 2025 \\
 \times 0795 \\
 \hline
 10125 \\
 18225 \\
 14175 \\
 \hline
 1609875 \text{ sq. ft.}
 \end{array}$$

Multiply then by height C to D = 13 ft. + one-third height of D to E = 3 ft. = 16 ft. :—

$$\begin{array}{r}
 160 \cdot 9875 \\
 \underline{16} \\
 9659250 \\
 \underline{1609875} \\
 2575 \cdot 8000
 \end{array}$$

If hay in stack is fairly well settled and weight per cubic foot 8.25 lb., this would give, according to table, 10 cubic yards to the ton, by which figure divide, as follows :—

$$\begin{array}{r}
 27 \overline{) 2576 \text{ cub. ft.}} \\
 \underline{10 \overline{) 95 \cdot 4} \text{ cub. yd.}} \\
 9 \cdot 5 \text{ tons.}
 \end{array}$$

The following table giving the weight and volume of different kinds of straw will be found useful for reference :—

				Weight per Cubic Foot. lb.	Cubic Yards per Ton.
Wheat ..	..	..	..	3.5	23.3
Oat ..	..	..	..	3.4	24.3
Barley ..	..	..	..	2.8	30.2
Pea ..	..	..	..	2.4	32.0
Bean ..	..	..	..	2.3	33.7

Field-day at Weraroa.—A field-day, attended by about a hundred farmers, was held at the Central Development Farm on 29th January. An interesting and useful time was spent viewing the farm and its operations under competent guidance. Among the live-stock the Red Poll herd attracted special notice. The seed-testing laboratory of the Biology Section also received much attention.

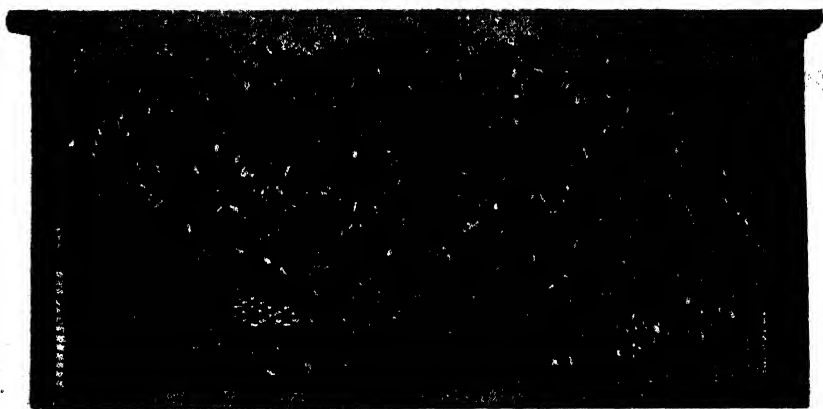


RYECORN FOR THATCHING AT RUAKURA.

ALUMINIUM HONEYCOMBS.

G. V. WESTBROOKE, Apiary Instructor, Auckland.

LAST October the Horticulture Division received from America two sets of the new metal honeycomb. One set each was sent to the Department's apiaries at Tauranga and Ruakura. At Tauranga the ten frames were put into a fairly strong colony, being inserted between the wax combs alternately. Although at the time there was only a slight flow of nectar the bees accepted the aluminium combs at once, first sealing up the base of the cells. In a few days the combs that were placed in the brood-chamber contained worker-eggs, which in due time hatched out. The metal combs in the super are, at time of writing, well filled with capped honey. The photograph shows one of



ALUMINIUM COMB USED AT TAURANGA APIARY.

the Tauranga combs with sealed brood and capped honey in the top corners. The bottom corners show part of the aluminium comb which has not yet been utilized by the bees. This comb was purposely selected to show the different stages. The other combs were fully occupied by brood or honey. At Ruakura each frame of the set was placed in different hives, so as to ascertain if they would be generally accepted. In no case were they discarded by the bees, but were as readily accepted as sheets of wax foundation.

These metal combs are not merely sheets of foundation, but are Langstroth frames in which thin strips of aluminium are ingeniously worked into the shape of worker-cells. These strips are secured to the frame by six strong wires running from the top to the bottom bar. The surface of the cells is slightly rushed with beeswax. The bees build on to these edges until the combs are such depth as the spacing

of the frames will permit. It is claimed that these metal combs enable greater production of honey, owing to the saving of time in building the wax; also that they extract cleaner, and save the loss of broken combs, destruction by insects, &c.

At the recent field-day held at the Ruakura Apiary these combs attracted considerable interest. At the close of the day a trial was given of extracting the honey from them. One comb from Tauranga, containing thick honey, was also placed in the extractor. The Ruakura combs, containing light honey, extracted readily. The comb with the thick honey, on extra speed being applied to the extractor, also yielded most of its honey, only a few cells retaining a small quantity. The results of this experiment seem to offer a possible solution of the thick-honey problem, as in no case did the combs, in spite of the high speed, show any signs of breaking. In fact, it is reasonable to suppose that with a power-driven extractor they would stand a very much greater speed.

Judging from the results of the experiment, the claims of the manufacturers do not appear at all unreasonable, although some beekeepers are afraid that metal combs would not do for the brood-chamber in the colder climate of the South Island. This, however, is a matter that will be further tested by the Department, and these metal combs will be tried on a larger scale next season, together with aluminium sheets which have just arrived from England. These have been put through the embossed rollers used for wax-foundation-making at Ruakura and have taken the impression of the worker-cells. They will be tried forthwith and reported on later.

Bee-culture at Avonhead.—At the Avonhead Training-farm for returned soldiers, near Christchurch, forty colonies of bees have been established, including ten for queen-raising. Experiments are being conducted with three kinds of hives.

Field-day at Ashburton Experimental Farm.—A field-day at this farm, held under the auspices of the local Farmers' Union on the 10th December, was attended by some two hundred people, who displayed much interest in the work undertaken.

Analyses of Limestones.—Recent analyses of limestone samples by the Chemistry Section gave the following percentages of carbonate of lime: Hastings, 88.5; Carterton, 86.5 and 91; Puwera, 84, 75, and 71 Warkworth, 72.

Duroc Pigs.—When at the Agricultural Fair at Toronto last year Mr. W. Dempster especially noticed the fine exhibit of Duroc pigs, a favourite breed in Canada. In colour the Duroc resembles the Tamworth, but is shorter in the legs and broader in the shoulders, while the hams are also well developed. The body is of good length and makes first-class bacon. These pigs mature very early, and are also easily fattened.

POULTRY ON THE FARM.

F. C. BROWN, Chief Poultry Instructor, Wellington.

A FARMER'S wife recently wrote for advice as to the poor results obtained from her poultry, stating that from seventeen hens only one thousand two hundred eggs had been produced for the year, or an average of a little over seventy eggs a bird. She questioned whether it would not pay better to get rid of the fowls and buy the eggs required for the house. The answer to this is a decided Yes, for if the same number of high-type laying-stock were kept, and fed and managed to the best advantage, at least double the number of eggs would have been produced. Even then from such a small flock an average of some one hundred and forty eggs for the year could only be considered a low one.

I would urge farming-folk who fail to make their poultry pay to ask themselves the following questions: "Does the poultry receive the same care and attention in regard to breeding as the dairy herd or the other classes of live-stock on the farm?" "Are they fed regularly, and to the same advantage?" "Are the other classes of live-stock kept beyond their best period of usefulness and allowed to die of old age, as is often the case with the poultry?" "Are the fowls properly housed and protected from unfavourable weather conditions, or allowed to roost in a tree or on the back of a dray?"

Those in the position of my correspondent would be well advised to do away entirely with their present stock and keep half the number of a purebred laying-strain. The cost of food would be less, while the actual return of eggs would be greater. As an instance, I may mention seeing last year on one farm a flock of one hundred pullets which gave an average of over two hundred eggs each for the year. What can be done on one farm can be done on another, providing that the poultry is given the same care in regard to breeding and general management.

This brings to mind a recent conversation with three farmers, two of whom declared that with the high cost of food it was impossible for fowls to show a profit over their keep. They were probably quite right, but only so far as the fowls they kept were concerned, these being generally of a nondescript collection. The third farmer had something better to say, and gave a clean-cut statement which showed that from eighty hens his wife made a profit of over £30 for the year, after deducting the cost of feed. In other words, she received this amount for the time spent in caring for her birds. Of course, seeing that the birds had a free range, allowing them to pick up a good part of their living, the net return is not by any means exceptional. If the flock had consisted of nothing but high-type young birds, and had been given the best of management, the profit would have been much higher.

If poultry is to be kept profitably on the farm it is imperative that old-time methods be changed. As success chiefly depends on the class

of stock kept, it is essential that the old barn-door or mongrel fowl be got rid of and none but the improved laying-type kept. Egg-production must be made the main aim, the table side of the business being treated as merely an adjunct.

THE BREED TO KEEP.

As to the best breed to keep, White Leghorns are undoubtedly the most popular from an egg-yielding standpoint, but they are unsatisfactory sitters. In fact, with a good laying-strain it is rare for them to show any sign of broodiness. Therefore, where artificial means are not adopted for hatching and rearing, the White Leghorn cannot be considered as an ideal farmer's bird. On the other hand, the Black Orpington or White Plymouth Rock will prove suitable breeds. Given the laying-strain of these general-purpose birds, the farmer has profitable laying-stock, and cockerels will pay to market, while he can also depend on having hens for hatching and rearing purposes. Of course, it is not the old exaggerated type of these breeds—created for the show-pen—which is recommended, but the medium modified type, in which egg-producing power has been developed with little or no harm to table qualities. Where the non-sitting breeds are kept—Leghorns, Minorcas, &c.—the only thing to do is to have an incubator, or purchase day-old chicks from a reliable breeder and rear them in a fireless brooder.

MANAGEMENT.

Having an egg-producing strain is only one essential requirement. If the birds are to give a maximum egg-yield, and consequently the highest profit, they must be hatched at the right time. To get long-season layers to commence in the month of April the heavy breeds should be hatched in August and the light breeds in September or early in October. The birds should receive liberally food of the best quality. In this connection it should always be remembered that the heavy layer cannot be overfed if the food is of the right quality. The day has gone for saying that a hen is too fat to lay. If she becomes too fat it merely indicates that she is not of a laying-type and should be culled out.

HOUSING.

Above all, poultry must be properly housed. All that is required is a partly-open-fronted lean-to building in which the birds can roost in comfort, remain during unfavourable weather conditions, and yet have ample exercise by scratching in litter, in which the whole-grain foods should be scattered. For large flocks the house should be 16 ft. deep, but with smaller numbers it is not practicable to have the structure so deep as this, and the shape must be squared up. In a general way the following dimensions are recommended: For fifty birds, 15 ft. deep by 12 ft. wide; for twenty-five birds, 10 ft. deep by 6 ft. wide. In providing housing-accommodation, and where runs are attached, it may be taken as a general rule that nothing less than 3 square feet of floor-space (to be ascertained by multiplying the length by the width) should be provided for each bird. In arranging the perches, 7 in. at least should be allowed for light breeds and 8 in. for heavy breeds. Do not have the perches on the old step-ladder

fashion. Keep them level and about 15 in. from the floor. They should also be removable, so as to facilitate cleaning and the prevention of insect pests. The floor of the poultry-house should be formed in such a manner that the birds have a thoroughly dry under-footing even in the wetter months of the year. With this in view it should be a few inches higher than the surrounding ground-level. Well-puddled clay, covered with tar and sand when thoroughly dry, makes a suitable floor for a poultry-house. Of course, concrete makes the best flooring-material of all, but this is comparatively costly, especially where suitable shingle is not near at hand. It is important to have a wire-netting run attached to the house, so that the birds can be confined during the morning until most of the eggs are laid. Where a run is not provided the birds are encouraged to lay anywhere, with the result that the eggs are often stale and dirty, and cannot be marketed with confidence.

CLEANLINESS.

By having the birds accommodated in a good house near the homestead the feeding and watering can be carried out in comfort in any weather, while the eggs can be gathered in a fresh, clean condition—an essential to obtaining their best market value. The house must be regularly cleaned, and given a periodical spraying with a strong disinfectant. The nests must also be kept in a sanitary state, and the nesting-material frequently changed. Strict attention to cleanliness is the secret of maintaining birds in a healthy thriving state, and of preventing insect pests.

BREEDING.

Another important point that must not be overlooked is the necessity of providing a breeding-pen. For the farmer to improve or maintain a heavy-laying flock he must get away from the common practice of indiscriminate breeding, such as the crossing and recrossing of different breeds generation after generation, and using eggs for hatching purposes merely because they happen to be at hand. Such a course tends towards reversion to the ancestral type and consequently a reduced egg-yield. The best advice that can be given is to keep only one breed of all black or all white, and to breed these in a state of purity whenever possible to do so. Such birds will not only give a better egg-return, but will be more uniform and attractive compared with the motley collections seen where crossbreeding is resorted to. Even when nothing but purebred strains are stocked it is necessary to have a breeding-pen, so that the eggs from none but the best laying-types are used for reproductive purposes. It must be remembered that there are good and bad layers in all breeds and strains, and that the laying-capacity may be developed or reduced according to the particular class of birds bred from. The law of nature is that like produces like, so that if weak parents are bred from, weak progeny will be the result.

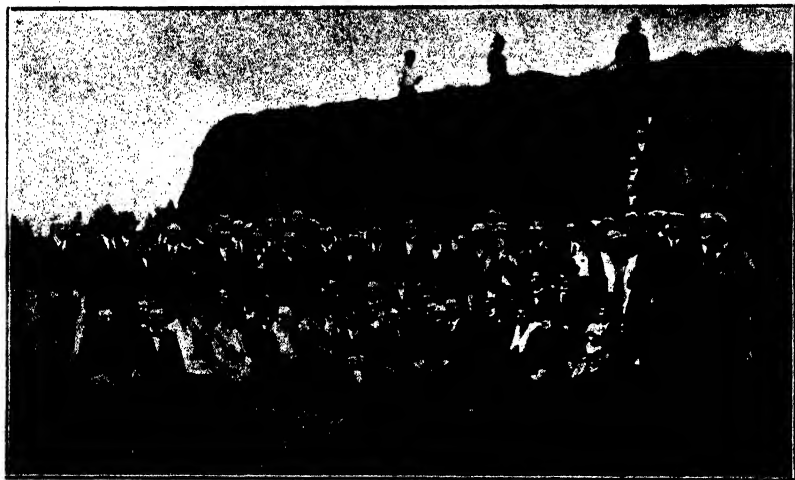
CULLING.

Still another important matter is to retain in the flock only birds that are showing or likely to show a decent profit over their keep.

Even after the first laying season the weak types should be culled out and only the best specimens retained for the second season. As a general rule, it does not pay to keep a bird after her second season of production, unless, of course, she is a desirable breeding-bird. Usually during the second year the egg-yield is about 30 per cent. lower than in the pullet season. After the second season the yield rapidly declines, while the production is mostly at a time when eggs are cheapest.

In regard to the weeding-out of unprofitable stock, the farmer must realize the importance of marking his chickens in order to distinguish the young from the old when culling is necessary—as it is every season if only profitable stock are to be kept. There is no hard-and-fast rule of telling the age of a bird after she has attained an adult stage of development. This being so, the punching of a distinct mark in the web of the foot is a good way of providing a means of age-determination. A punch for the purpose can be obtained for about 2s. 6d. The best time to cull a flock is just before the moulting-period. All things being equal—in regard to the time for hatching and also the general conditions under which the birds are kept—it is usually a safe course to discard the first birds to show signs of moulting, while the late moulters should be retained for laying and breeding purposes.

NEW SOUTH WALES STATE ORCHESTRA AT RUAKURA.



While at Hamilton last month the members of the orchestra visited the Ruakura Farm of Instruction. Special interest was taken in haymaking operations then proceeding. The visitors were entertained at afternoon tea at the homestead by Mrs. Green. In the group M. Henri Verbrugghen is indicated by an arrow.

WORK FOR THE COMING MONTH.

THE ORCHARD.

THE ENSUING EXPORT SEASON.

FAIRLY satisfactory progress has been made during the last three or four weeks relative to the export of fruit. Advance in this direction has been necessarily slow, owing mainly to the existing system of shipping-space control. Local authorities can do no more than recommend, the actual allotment of space being entirely in the hands of the Imperial authorities. However, through the efforts of the Prime Minister, made upon the recommendations of the New Zealand Fruitgrowers' Federation and the Department of Agriculture, space for the shipment of sixty thousand cases to the United Kingdom has been definitely secured. The local shipping committee has placed the allotment of this space on a *pro rata* basis in the hands of the New Zealand Fruitgrowers' Federation. In addition space has been secured for some twenty thousand cases for shipment to the United States and Canada.

The question whether or not this amount of space will be sufficient to satisfactorily meet the present season's requirements is causing some concern to growers and the Department alike. The primary considerations in connection with securing further space are: Firstly, the difficulty of inducing the Imperial authorities to allot for the carriage of fruit a greater proportion of the limited amount of cool-storage shipping-space at their disposal; secondly, whether sufficient fruit would be available to readily fill any additional space secured; thirdly, in the event of sufficient fruit being available, whether, under existing conditions, it could be graded and packed in accordance with the standards required for export.

An indication of whether further space is in demand should be available as a result of applications for the space now being offered, closing on 16th instant. Should the applications suggest that further space is in demand every attempt will be made to secure it, and the matter of the satisfactory preparation of the fruit required will be a matter for the packers' attention.

Supplementing last month's notes relative to the care necessary in handling fruit for export, I would point out that New Zealand fruit is scarcely known on overseas markets. It has yet to make its name. On the other hand, fruit from the United States and Canada is well known and appreciated on the markets of the world, owing to the high standard of the North American pack. At the present stage we aim not at competing with but following so far as possible those countries on the principal overseas markets. Therefore it is essential that our pack should be of equal quality, and that this be attained at the outset. We propose adopting the same grade terms used by the United States and Canada. The advantages of so doing are obvious. Buyers will be enabled to continue business throughout the year with freedom and con-

fidence, and, further, considerable advantage will come to us through the extensive advertising which has already been done relative to the grade terms used. These advantages, however, depend entirely upon our pack being of a standard equivalent to that represented by the American grade terms.

—J. A. Campbell, Assistant Director of the Horticulture Division.

AUCKLAND.

During March some varieties of stone-fruits will remain to be harvested, but work in the main will be directed towards the effective marketing of the greater part of the mid-season pip-fruits.

Up to the time of writing, brown-rot has been little in evidence as compared with the last two seasons, but a short spell of humid conditions would be conducive to fresh infections; therefore continue applications of commercial lime-sulphur, 1-125, to peaches, plums, and nectarines. This will also serve as a check to rust infection.

Despite the dry weather conditions experienced black-spot persists, leaf-infection being very marked in apples. Arsenate-of-lead sprays should be continued for the control of codlin-moth. A further hatch is to be expected, infecting later varieties of apples, pears, and quinces. When applying this spray add commercial lime-sulphur, 1-100, as previously recommended. Woolly aphid may be expected to attack with renewed energy during the fall period, and combative measures in the use of Blackleaf 40, 1-800, should be adopted. Continue applications at intervals throughout late summer and until such times as the falling of leaves permits of the use of oil sprays.

Several forms of canker are causing damage to orchards in the district, and in cases where such infection is identified growers should use every endeavour to remove parts so infected by cutting away with a sharp knife and destroying them by fire, as they are a source of further infection. The wounds thus made should be washed with corrosive sublimate, 1 part to 1,000 parts of water, using a small brush, and painted over afterwards with coal-tar. After each cut the knife or seccateurs must be sterilized by dipping in a solution of formalin, 1 part to 20 of water. Care must be exercised in the use of corrosive sublimate, which is deadly poison.

The completion of budding operations should be pushed forward while the sap is well up. Summer pruning may now be finished. Stone-fruit growers are advised to thin out heavy growth, especially that on the inside of the trees, so as to admit light and air.

The immense value of thorough cultivation has been amply demonstrated this season, in which such dry conditions have been experienced. There is not likely to be a better object-lesson in this regard for some time to come, and it is to be hoped that the sufferers will take a warning and note their shortcomings in this important work.

Some citrus-growers are experiencing trouble with the cottony cushion scale (*Icerya purchasi*). This may be dealt with in the same manner as thrip; immediately young growth is sufficiently hardened to permit of it spray with red oil, 1-40. Further dying-back of the tips of the previous season's growth on citrus trees touched by last season's frosts is in evidence, and as this invites attack from the citrus borer all such dead wood should be removed, cutting well back below the dead portion and immediately above a bud.

Spraying summary: The compounds and strengths given in last month's notes are again recommended.

—J. W. Collard, Orchard Instructor, Auckland.

HAWKE'S BAY.

Cultivation should be continued wherever possible, in order to maintain moisture sufficient to mature the fruit and promote development of sound buds for next season. The season being a dry one, cultivation has proved a boon where carried out properly.

The various spraying compounds and dilutions mentioned in last month's notes are still seasonal for the control of pests and diseases, and little can be added except to emphasize the necessity of safeguarding against a late attack of codlin-moth and infection of black-spot.

—W. M. Rice, Orchard Instructor, Hastings.

MOTUEKA.

By the time these notes appear in print the export season will have arrived. The thinning from the trees of the fruit selected for shipment will undoubtedly be to the advantage of that left on the trees until a more ripened stage is attained. When selecting from the trees the fruit required for export "cull" fruit should also be gathered, thus relieving the trees of superfluous inferior fruit and giving added zest to the trees and remaining fruit.

Growers will be well advised to pack consistently to the standard grades throughout the season. They should not by any means be disheartened at any little set-backs experienced in the early stages of their initial efforts. It must ultimately become the backbone of the selling system to have uniform recognized standards that buyers can depend upon.

Spraying measures for the coming month will consist of keeping a coating of arsenate of lead on the fruit to prevent attack by late broods of codlin-moth, also to prevent the ravages of leaf-roller caterpillar in fruit after storage. At the same time a late application of lime-sulphur, 1-120, on fruit for storage will tend to reduce largely the development of black-spot on fruit after being placed in storage, as was experienced last season.

—W. T. Goodwin, Orchard Instructor, Mptueka.

CANTERBURY.

Leaf-roller caterpillar will probably become troublesome during March, and it will be advisable to give another spraying of arsenate of lead for its control. This will also cope with any late attack of codlin-moth, especially in the late varieties.

Powdery mildew is on the increase very badly all over the district, and many varieties of apples, especially Sturmers, are suffering in consequence. Much good can be done by cutting off the affected laterals and burning them, giving the trees a good spraying with lime-sulphur, 1 to 100 or 120, or atomic sulphur, 8 to 10 lb. per 100 gallons of water. This will also help to check the spread of red mite, thus preventing the laying of winter eggs. Where woolly aphid is present continue to spray with Blackleaf 40, driving the spray well into the colonies. By doing this many of the winged forms that will be appearing about this time will be destroyed. Good results have also been obtained by giving the trees a thorough application of red oil at strength 1 to 60 or 80, after the fruit is picked.

Any budding not done in February may be continued in the early part of March, choosing well-matured buds from healthy trees for the operation.

There are still many growers too careless about the marketing of their fruit, and already several lines have been condemned and destroyed locally. It should be known that fruit affected with codlin-moth, mussel scale, red mite, leaf-roller caterpillar, or black-spot is not allowed to be placed in the market for sale, and consequently such affected fruit should either be destroyed in the orchard, thus saving further trouble and expense, or, with the exception of cases of moth infection, be dealt with as follows: Fruit affected with mussel scale and red mite may, after being thoroughly cleansed of these pests, be placed on the open market or disposed of to a canning-factory. Fruit affected by leaf-roller caterpillar or black-spot may be disposed of to a canning-factory, provided the grower has been furnished with the necessary departmental authority in the form of a permit issued by the local Orchard Instructor.

Grading and packing still leave much to be desired, and it would be well for growers to make themselves acquainted with the proposed regulations for local sale and work accordingly. It will save much trouble when the regulations are made compulsory. All information can be obtained upon application at the office of the Orchard Instructor.

—G. Stratford, Orchard Instructor, Christchurch.

OTAGO.

At time of writing the stone-fruit harvest is in full swing, and good crops of early varieties of peaches and apricots are being marketed. Both black and green aphid are troublesome in some orchards, and greater attention should be paid to their control, as fruiting-wood will not develop where this pest gets a good grip. Spray with Blackleaf 40, 1-800, and repeat if the pest is still in evidence. Rust has also made its appearance. The later varieties become badly affected in both

size and appearance if this fungus disease is not kept in check. Use lime-sulphur, 1-140, in cool weather if possible, as injury sometimes results if too hot. Red mite is also affecting some of the peaches. Lime-sulphur at the same strength will keep the pest in check; or atomic sulphur can be used at 8 lb. to 10 lb. to 100 gallons water. Black-spot is not nearly so prevalent as last season, and not likely to be if the weather keeps good, but if damper weather sets in it may become infectious later, and the trees need to be carefully watched. Where applications of lime-sulphur or atomic sulphur are being given for powdery mildew no trouble should arise with black-spot.

Owing to the backward season codlin-moth was late in hatching, but there are a fair quantity of apples affected through insufficient spraying at the critical time. These should be picked off and destroyed before the grubs escape to their hiding-places. Cherry-leech is not receiving the attention it should in some cases; neglect to destroy this pest results in stunted trees and poor crops on pears also. An application of arsenate of lead at 1-30 is all that is required.

Summer pruning can now be done. Clean out the centres of stone-fruit trees. The fruiting-wood will ripen up better for next season, and in the case of late peaches their ripening will be advanced. Apples can also be summer-pruned now, but not too drastically. Clean out the centres prior to spraying for woolly aphid, which is now becoming far too prevalent, using Blackleaf 40 for the purpose, at 1-800.

Budding can still be proceeded with, choosing well-ripened buds for the purpose. It is a good plan to put plenty of buds in. Some can be removed later if too many succeed.

Spray strawberry plants now for leaf-spot with bordeaux, 4-4-40.

—J. H. Thorpe, Orchard Instructor, Dunedin.

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

MANAGEMENT OF THE DEVELOPING PULLETS.

NEXT month should see the majority of the pullets exhibiting signs of coming to laying-point, such as making a cackling noise, showing a red developed comb, a fullness in the abdominal region, and generally an adult shape. Therefore no time should be lost in getting the young birds into their permanent winter quarters. It is of the greatest importance that they be well settled down before their productive season commences. Changing the pullets from house to house at this particular stage of their development is a most common cause of their going into a moult with the adult birds, and this at a time when eggs rapidly advance in price. The same result may be brought about by changing the food, or by subjecting the birds to fright by rough handling, &c. It will therefore be seen that the more uniform the treatment pullets receive just before or after they have attained a laying-stage the less risk will there be of their going into this premature moult. Of course, very early-hatched pullets will probably be laying before this, but in most cases they will moult in the late autumn even when given the best of care and attention. As a rule, however, the moult is a light one, and if the birds are well fed and housed they will soon recover and attain a productive condition.

On no account should a pullet be encouraged to lay before it reaches an age of six months at the least. The great drawback to too early

maturity is that the bird seldom grows to a desired size, nor lays a good marketable egg, and consequently never makes a desirable breeding-specimen. By this it is not to be inferred that the laying-period should be delayed by supplying a scant ration or one of inferior quality; indeed, the feeding of the growing pullet cannot be too liberal, but it should be plain, consisting chiefly of good sound grain materials, and as much green stuff as it will eat. Where the danger lies is including in the ration too much rich food, such as meat or its substitutes. These foods tend to stimulate the reproductive organs before proper development has been attained.

Hand-in-hand with liberal feeding should go clean and comfortable housing. Never place the pullets in quarters where adult stock have been kept, until such quarters are well cleaned and the whole of the interior of the house is given an application of whitewash or a spray with strong disinfectant. This will give the assurance that no insect pests are present. If the pullet is to maintain her bodily health and produce a heavy yield of winter eggs it is of the greatest importance that she be kept free from vermin, particularly the red mite. See that the floor of the house is maintained in a dry state. It should be raised a few inches above ground-level to assure this end. It should also be covered with straw or similar litter, in which the whole-grain food is daily fed. This will keep the birds busy in scratching for the grains. Always remember that it is the dry-footed hen, given ample space for exercise under cover, that gives the best return during the cold wet months of the year. Care must be taken that the front of the house is well opened up, so as to admit an ample supply of fresh air and sunlight to all parts of its interior. In order to prevent draughts the sides and back walls should be free from cracks. The slightest crevice or crack should be stopped, or colds, roup, &c., are apt to follow as a result. The houses should be occasionally visited after dark, and if any of the birds are found to be sneezing or breathing heavily the cause should be looked for and removed at once. A little Condy's crystals put into the drinking-water—say, sufficient to give it a rich pink colour—will usually check and prevent colds from spreading.

When the pullets are commencing to lay they should be watched for a time, and discouraged from laying their eggs in odd corners of the house instead of in the nests. Generally speaking, if one bird is allowed to lay its eggs on the floor of the house others are apt to do the same. This means that the eggs are likely to be covered up in the litter, and are not gathered in a fresh condition. Placing an obstruction where the bird has acquired the habit of laying, having the nests slightly darkened, and providing ample nest-boxes as well as nest-eggs will usually have the desired effect. Poultry-keepers should not on any account let high prices for eggs lead them to overforce the young pullet with rich foods, or ovarian troubles are almost sure to result. To secure a good winter egg-yield some forcing-material is essential, but this should be introduced by degrees and at all times used with strict judgment.

It is advisable in poultry-keeping generally to neglect no detail in regard to cleanliness, proper feeding, housing, and general management, but with the pullet intended for winter laying this attention to detail is imperative.

LAMENESS IN YOUNG DUCKLINGS.

Many complaints have reached me of late regarding lameness and loss of leg-power in ducklings that were being reared by artificial means. This may be due to having the drinking-vessels insufficiently deep to allow the birds to get their heads well under the water for keeping their nostrils from becoming clogged up with food, &c. Another and the most common cause is dampness in the sleeping-quarters—allowing the ducklings to sleep on wet bedding-material. Curing this leg trouble is out of the question; the only safe course is to prevent it. The first step in this direction is to provide drinking-vessels which will allow the young birds to get their heads well under the water. Further, care must be taken to keep the bedding-material in a dry state, and with this in view the drinking-vessels should be placed well away from the sleeping-compartment. This will go a long way to prevent the droppings from the birds, after drinking, coming into contact with the bedding. In furtherance of this end a good plan is to have a low wooden frame covered with small-mesh wire netting, on which to stand the water-fountain, while a flat dish is placed underneath. Then the droppings, when the ducks are drinking, will fall into the dish. This will help greatly towards keeping the quarters in a dry state and the birds healthy.

THE APIARY.

G. V. WESTBROOKE, Apiary Instructor.

WHEN removing honey from the hives the question of winter stores should not be lost sight of, especially in view of the existing sugar-shortage. The improved price obtained for honey during the past few years has tempted many beekeepers to extract bare and feed back sugar as required, but they would be well advised to make sure the bees have plenty of stores to last them until the next season's honey is coming in freely. For this purpose each hive would require not less than 40 lb. of honey. In order to arrive at the amount of honey in the hive it will be necessary to make a thorough examination. Do not be content to simply leave the bottom box, as so many beginners do, assuming that it is full of honey. In most cases it is mainly composed of brood, and losses have been frequently suffered in this way. Half-starved colonies never winter well, and open up poor in the spring. On the other hand, those which have been left with an abundance of stores are invariably in the best condition in the spring, and commence brood-rearing much earlier than would otherwise be the case.

In districts where thick honey, or honey that cannot be extracted by the ordinary extractor, is obtained, it should be set aside for winter stores, but care must always be taken to prevent any honey from a hive infected with disease being given to a clean colony. It is always a good proposition to extract all the clover or light honey for the market, leaving the darker and stronger flavoured as far as possible for the bees.

DEALING WITH THICK HONEY.

In districts where all or nearly all the honey is too thick to be separated from the combs by the extractor the beekeeper will need to adopt other methods of dealing with it. In the past the method has been to cut it out of the frames and put it through a honey-press, but the honey-melter is now largely used for this purpose. In using the melter it is necessary to see that the honey and wax run away as soon as melted. It is also advisable to allow the honey to cool as soon as possible. For this to be accomplished it will need to run direct from the melter into a separator, which, when full, allows the wax to run off into one vessel and the honey into another. Honey will not be materially affected by the heating, provided it does not remain at a high temperature for more than a few minutes.

In districts producing such thick honey the wiring of frames in the supers may be dispensed with, as it would be a waste of time and trouble to wire them when they have to be cut out to secure the honey. In the past the raising of "section" honey has not been encouraged, but now that the price for this class has improved it may be worth considering if it would not be the best method of honey-production. Where, however, it is possible to produce extractable honey doubtless the latter is still the best paying proposition.

CLEANING UP WET COMBS.

A matter which requires prompt and careful attention is that of putting out the "wet" or newly extracted combs for the bees to clean up. This should always be done at the close of the day, in order to prevent the bees starting to rob. At this time of the year, when the honey-flow is about over, it does not take much to start them. For this reason the honey-house should be bee-proof, and the wet combs be placed on the hives in the evening when the bees have ceased flying. A useful contrivance for the cleaning of wet combs is what is known as the Deadman super-cleaner, which was fully described in the *Journal* for July, 1918. The contrivance has proved very successful in the North Island, but reports from the southern districts tend to show that in some cases where it was used the bees did not work out the outside supers, possibly owing to the weather proving too cold to allow them to do so.

FOUL-BROOD.

At this time, as at all times, the beekeeper will need to be on the lookout for this dreaded disease, and when discovered it should be treated at once. Never allow the bees to go into winter quarters with the slightest touch of foul-brood. Experience has shown that colonies left untreated with but a few cells of foul-brood, even though strong, have almost invariably died out in the spring. The disease makes very rapid progress owing to the young larvæ being fed from the infected stores in the hive. The only safe method is to treat the colony as soon as the trouble is discovered, taking great care to prevent any bees obtaining access to the honey while treating. In autumn and winter treatment it may be advisable to simply shake the bees on to fully sealed frames of honey from a clean hive, and watch for signs of foul-brood in the spring.

VITICULTURE.

S. F. ANDERSON, Vine and Wine Instructor.

THE COMING VINTAGE.

IN this country March is the chief month for the vintage. The main secret of making a good wine is in having good grapes. In New Zealand our wine-grapes never get overripe for winemaking, the chief anxiety of the vigneron being to get them ripe enough. When fit for gathering they should have attained their maximum of sweetness, showing on the hydrometers as follows: Guyot's glucometre, from 18 to 24 per cent. of natural sugar; if it is the Baume scale, then it should be between 12 and 14 per cent.; if the specific gravity scale is used, then the density should be between 1.090 and 1.108. The Hunter River saccharometer is approximately the same as the Guyot, with the difference that in using the former instrument the temperature of the must is tried when at 80° F. With all the others the test should be at 60° F. or 15.5° C.

As the time for gathering the grapes draws near they should be tried by selecting a few bunches showing an average of the crop. These are pressed out, strained, and put into the test-tube, the instrument floated in it, and the density noted. The general excellence of the wine—in colour, alcohol, acidity, keeping-qualities, and the condition for obtaining a clear, bright sample—depends on the grapes being gathered when at their maximum of ripeness. The acidity of the must need not give the vigneron concern at this stage, as that is always sufficient in New-Zealand-grown grapes.

The dates of commencing the vintage in Hawke's Bay have varied from the middle of March to the middle of April. Only in exceptional years does the grape gain natural sugar after the end of March. The following gives the names of grapes in their order of ripening and the average sugar test of each over a period of nine years: Pineau Noir, 21.5 per cent.; Pineau Meunier, 20.5; Pineau Gris, 24; Shiraz or Hermitage, 17; Cabernet Sauvignon, 18.5; Malbec, 17; Pedro Ximenes, 16; Pineau Chardonay, 16.25; Riesling, 17.

When the fruit is coloured, should the weather be dull and damp, it is a help to its drying rapidly to strip off the lower leaves.

The grapes are generally cut off with small seccateurs or knives into boxes or kerosene-tins, and a great many of the berries fall on the ground. A much better way is to have light trays about 4 in. deep, or milk-dishes. These are pushed under the vines and the bunches dropped into them. At the same time all falling berries are caught in the tray.

As the vintage draws near the vigneron will have a fair estimate of the quantity of wine to be made, and should provide the necessary casks in good time. They are not always to be obtained in a hurry. All the necessary plant should be provided, cleaned, and put into thorough working, hoops driven on, &c. The fermenting-vats require particular attention. More good wine is spoiled by mouldy and bad-smelling casks than would pay for much trouble in these vintage preparations.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

THERE is little requiring to be done at this time in planting and sowing, the principal work being attention in various ways to growing crops.

Turnips may be sown up to the end of March, about the middle of the month being the time most widely suitable. Spinach may also be sown in the warmer districts up to the end of March, but for most places a month earlier is advisable. Sowings of lettuce and radish may be made.

Peas: The earliest crops of peas are secured by sowing about mid-March, a practice applicable only to localities that enjoy a mild winter climate with little or no frost. The purpose of sowing peas in autumn is, of course, to get early crops. Peas do best in a medium temperature, and only do indifferently during the summer months in the north. A fair amount of sunlight and heat is necessary to cause them to pod, and these conditions are not present in most places till the end of October at the earliest. In such places all that autumn sowing can do is to get the plants more advanced in growth than those sown in spring. If sown too early the tops may get too long and become worn by weather. Therefore the last half of May is early enough to sow. In exceptional places, both in the North and the South Island, warmer conditions enable the plants to pod a month or more earlier. From these places the early market is supplied. Sowings are made in March, as already stated above.

In northern districts cauliflowers, cabbages, leeks, and celery may still be planted, and lettuces in all places.

Tomatoes: Keep side growths in strict subjection. Spray with 4-5-40 bordeaux, after rain, or frequently enough to keep a trace of the mixture on the leaves. To conserve the strength of the plants fruit may be gathered when the first faint tinge of colour shows. The fruit is then more advanced than it appears, as colouring begins inside the fruit.

Celery: In most parts of the Dominion celery-growing is not attended with any difficulties, but in the warmer parts it is a troublesome crop to manage. Cool conditions suit celery best, and where such conditions exist very little watering is needed after the plants are established. Where the climate and soil are hot, however, a good deal of watering is required, and rust is often troublesome as well as leaf-spot. Where these diseases have to be contended with the plants should be kept covered with a film of bordeaux or burgundy mixture, the formula being 2-2-40 for lime-bordeaux, or 2-3-40 when soda is used in place of lime, the "3" meaning pounds of soda.

Broad-bean rust: This disease is very troublesome in some parts, so much so that the crop is becoming impossible in certain places. It is useless to try to control the disease unless the source of infection is removed. The disease winters on the old leaves and stems of the plants.

All infected plants should be destroyed by burning, care being taken that no leaves escape the fire. If any of the leaves are ploughed or dug into the ground, or placed on manure-heaps, the disease is sure to recur. Authorities hold that the disease cannot become epidemic if such precautions are taken. Some growers think the disease comes on the seed-beans, but I may mention that a few beans sent here from an infected crop and planted in my own garden resulted in a perfectly clean crop.

Cultivation and fertilizing : Cultivation should be given often enough to keep the surface soil loose and to prevent the growth of weeds, which rob the crops of moisture, usually none too plentiful at this time. The present is a good time to scarify couch and other weeds out of the soil. Cultivation has great effect on the growth of advancing crops, and no one can afford to neglect it. In these days most gardeners have to rely on artificial fertilizers, and these are usually deficient in nitrogen—at least, in a form that is readily available. Crops often are slow in starting, a very undesirable thing at this time, above all others, when the diamond-backed moth is threatening. It is best not to risk a slow start, but to give some nitrate of soda as soon as the plants get hold of the ground after being transplanted. The best way to give the nitrate at this season is in liquid form. Dissolve the salt in water, allowing 1 oz. to each 3 gallons, and give sufficient to moisten the soil around the roots. Nitrate of soda is good for most crops, particularly the cabbage tribe and leeks.

Green-manuring crops : Humus is a necessity to soil-fertility. Where stable or farmyard manure is not available some crop for turning in should be sown on vacant plots. Lupins, field-peas, or partridge peas are more suitable than oats, which latter are most frequently used for the purpose. Land should not be cropped immediately after turning a green crop under. The green matter should have time to decay and the soil to settle down. If a good crop is turned under the capillarity of the soil is hindered for a time, and crops may do but poorly if put in at once.

FORTHCOMING AGRICULTURAL SHOWS.

Broadwood A. and P. Association: Broadwood, 26th February.

Franklin A. and P. Society: Pukekohe, 27th and 28th February.

Northern Wairoa A. and P. Association, Mititai: 28th February.

Waikato Central A. Association: Cambridge, 2nd and 3rd March.

Taranaki Metropolitan Agricultural Society: New Plymouth, 3rd and 4th March.

North Kaipara Agricultural Association: Paparoa, 5th March.

Te Aroha A., P., and H. Association: Te Aroha, 9th and 10th March.

Hukerenui Agricultural Association: Towai, 11th March.

Ashburton A. and P. Association: Ashburton, 18th March.

Hawke's Bay A. and P. Society: Hastings, 23rd and 24th March (Autumn Show).

Oxford A. and P. Association: Oxford, 8th April.

Methven A. and P. Association: Methven, 15th April.

Manawatu and West Coast A. and P. Association: Palmerston North, 22nd. to 25th June (National Dairy Show).

(A. and P. Association secretaries are invited to supply dates and location of their shows.)

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

COWS AND SOIL-DEFICIENCY.

"DAIRYMAN," Awakeri, Whakatane :—

Since coming to this district my cows have developed a craving for chewing bones, pumice, and wood. I have supplied rock salt, but that has not satisfied them. There is evidently something lacking either in the soil or in the pasture, as most of the cattle in the district seem to have the same craving. Could you tell me of a cure?

The Live-stock Division :—

The craving mentioned is the result of the cattle grazing on pasture lacking in a sufficient supply of one or more of the constituents necessary for rendering plant-growth capable of maintaining the animal's body in perfect health. The trouble is usually met with only on country of a light nature, and more particularly where the pastures have become more or less exhausted as a result of prolonged use without manuring. Where these conditions exist a form of malnutrition affecting cattle, particularly milking-cows, is often met with. The symptoms of this trouble are a stiffness of gait resembling severe rheumatism, and a gradual loss of condition, progressing until the animal becomes very weak and emaciated, in which state it often remains for months, death frequently resulting unless proper treatment is applied. As indicated, when cows develop a craving for chewing bones, wood, &c., it is a sign that the pastures where animals are running should either be renewed or top-dressed with basic slag or other suitable manures. Should your cows develop the symptoms of malnutrition described the following treatment is recommended: Give twice daily 1 oz. of compound syrup of phosphate of iron (Parrish's Food). The syrup should be mixed in about 1 pint of water and sprinkled on sufficient bran to absorb the liquid.

HARD BUTTER.

V. P., Devonport :—

We keep a cow (a Jersey) and make our own butter. It is usually so hard as to be almost impossible to spread it upon bread. Can you please inform me, is there a convenient method of treating the cream or butter to lessen the hardness of it?

The Dairy Division :—

It frequently happens that where butter is made from the milk of an individual cow difficulty is experienced towards the end of the lactation period in producing a butter of normal composition, as at this stage the proportion of harder fats has considerably increased. If the cow is given quantities of succulent feed, this has a tendency to overcome the hardness in the butter. The pasteurization of cream is also helpful in the same direction. This can be done by placing the vessel containing cream in boiling water, allowing the temperature of the cream to rise to 180° F., and then immediately cooling it to a low temperature by placing the vessel in cold water. The cream should be frequently stirred during the process of heating and cooling.

HOME STORAGE OF APPLES.

A. B. MUGGERIDGE, Manutahi :—

Could you advise me as to the best method of keeping apples through the winter?

The Horticulture Division :—

It is, of course, understood that only certain varieties of apples can be kept through winter—namely, those that are naturally keeping-varieties. The fruit should be gathered at the right state of maturity. As soon as it distinctly shows the colour it should have when ripe it is ready to gather, this meaning that the fruit must be mature but not approaching a mellow condition. For this reason a crop should be taken in several gatherings. The greatest possible care should

be taken to prevent bruising. If the fruit is gathered while hot from sun-heat the boxes should be placed in an airy, cool shed where they will be shaded from the sun, and left there until the fruit is cool. The conditions necessary for storing are a low temperature (not freezing), a still atmosphere, and darkness. Some top ventilation is necessary to allow the escape of carbonic-acid gas which rises from the fruit. Storehouses of a number of different designs have been built, such as slab houses thatched with straw, or the entire building constructed of straw packed between wire netting, also buildings of concrete. For the purpose of storing a comparatively small lot any suitable shed or room can be used. The fruit should be paced in bins in bulk, not in single layers, and neither straw nor any such material should be used for laying the fruit on.

DOG WITH SPLIT PAD.

"SHEPHERD," Napier :—

I have a sheep-dog which has split a pad on one of his front feet—probably in fighting. Please advise me how this may be cured.

The Live-stock Division :—

The wound should be thoroughly cleansed with a warm antiseptic solution ; it should then be washed twice daily with a solution of 2 drams of zinc sulphate to 5 oz. water. The foot should be bandaged and kept as clean as possible between the washings.

TAGASASTE SHELTER FENCE.

NORMAN R. WILLIAMS, Hornby :—

Could you tell me how to sow tree-lucerne seed to form a shelter fence ? The fence is intended to cut off the draught which comes under an old row of pines. I intend to plant the hedge about 10 ft. from the pines.

The Horticulture Division :—

The most effective shelter is secured by having the plants in a double row. The rows may be about 12 in. apart. The plants should be 3 ft. apart in each row, and arranged so that those in one row are opposite the intervals in the other row. The seeds may be sown at any time, except perhaps midsummer, when the soil might be too dry. The soil should be well broken up and cleared of weeds. Sow the seed about 1 in. deep, dropping two or three where each plant is to stand, and thin out surplus plants. If the seeds have been stored for a time they should be softened by pouring boiling water on them. Leave them in the water for eight or ten hours, and then sow at once. It is presumed that the plant you refer to is tagasaste (*Citrus proliferus*). The real tree-lucerne is *Medicago arborea*—quite a different plant.

SEGREGATION OF RAM LAMBS.

"CAMPUS," Otaki :—

At what age should ram lambs be segregated ?

The Live-stock Division :—

Ram lambs should be segregated when they reach the age of six months, especially with pedigree stock, in which maturity is reached earlier than with others.

SHELTER-TREES FOR HAWERA DISTRICT

A. J. HASELTINE, Hawera :—

Please inform me as to the best trees to plant for shelter, the time to plant, and the distance between trees. The ground on which the trees are to be planted is swept by westerly and southerly winds, and also receives a fair amount of salt spray.

The Horticulture Division :—

Pinus muricata is probably the best tree for your purpose, as it stands both wind and salt spray. The best time to plant is July or August, according to the state of the soil. Plant about 8 ft. apart in at least two rows. The trees in one row should be placed opposite the intervals in the next row.

NOTICE.—"Subscriber's" inquiries regarding lucerne and sorrel cannot be answered unless name and address are supplied.

IMPERIAL REQUISITION OF WOOL.

THE following circular, dated 27th January, 1920, has been issued by the Department of Imperial Government Supplies :—

The Department has reason to believe that certain wool-growers are holding back their wool under the impression that it will be free from the Government requisition after 30th June, 1920, and available for private disposition. It is advisable, therefore, to state definitely, for the information of all concerned, that this is not so, and that wool clipped, and wool produced at freezing-works on or before that date, cannot be exported from New Zealand, and that its sale otherwise than to the Government will be an offence. The same position applies to skins from stock slaughtered (other than those at freezing-works) prior to 30th June, 1920. It is requested that brokers and freezing companies take immediate steps to make the position in this respect clear to their clients.

ESTIMATED YIELDS OF WHEAT AND OAT CROPS.

THE following estimated average yields per acre of wheat and oats for the season 1919-20 have been compiled by the Government Statistician, from reports furnished by Inspectors of the Department of Agriculture throughout the Dominion, and issued under date 10th February :—

District.	Wheat. Bushels per Acre.	Oats. Bushels per Acre.
North Island	30·31	35·25
Nelson	19·97	25·00
Marlborough	28·47	43·89
Canterbury	29·16	38·45
Otago	28·89	38·49
Southland	31·76	38·60
Average (estimated) for the Dominion, season 1919-20	29·10	38·35
Average (actual) for the Dominion, season 1918-19 ..	31·57	39·87

In accordance with the above estimates, the total yield of wheat for the Dominion should be approximately 4,100,000 bushels, as against an actual yield of 6,567,629 bushels for the season 1918-19.

The percentage of oat crop threshed in 1918-19 was 35·44 of the total area under that crop. Assuming that a similar proportion is threshed this year, the total yield of grain should be 5,575,000 bushels. The oats threshed in the previous season yielded 6,884,609 bushels.

The reports of the Inspectors may be briefly summarized as follows :—

North Island.—Crops in the Rangitikei district (the principal grain-growing district of the North Island) are, generally, in good condition. The cold wet spring, followed by an extremely dry summer, has not been to the advantage of Hawke's Bay. Taranaki is fair, whilst in southern Wairarapa crops are affected with smut.

Nelson.—Fair average crop.

Marlborough.—Generally speaking, an average crop. Heavier lands show greater promise than light, owing to the long dry spell. Some crops discoloured by recent rain.

Canterbury.—Good crops. A late frost was experienced, but the damage done was slight. Rust showing in the northern districts, whilst isolated cases of the disease known as "take all" have occurred in the central and southern portions.

Otago.—Crops generally in good condition, but expected to be late. In Maniototo, Vincent, and Lake Counties crops poor and light.

Southland.—Present weather is not very favourable, and crops are fairly light.

Stud Southdown Rams.—The Department's Ruakura Farm has for sale twenty good-quality two- and four-tooth Southdown rams bred at the farm. Communications should be addressed to the Manager, Ruakura Farm of Instruction, Hamilton East.



The New Zealand Journal of Agriculture.

VOL. XX.—No. 3.

WELLINGTON, 20TH MARCH, 1920.

TAKE-ALL DISEASE IN WHEAT.

INCIDENCE IN NEW ZEALAND.

R. WATERS, Biological Laboratory.

THE often disastrous effect of the disease here dealt with upon the wheatfields of certain of the Australian States has well merited the adoption there of the name "take-all." In England, France, and Germany it has been sufficiently serious to demand the careful attention of those interested in the conservation of wheat. The disease was reported in 1916 as not then known to be prevalent in the United States of America; since then, however, it has been reported in fresh localities there. So far as New Zealand is concerned, the descriptions of experienced growers indicate that take-all has been present for many years. Although this season traces of it have been seen in widely separated portions of the Canterbury District, and the damage from its attack has been very considerable in a few isolated cases, it has not yet become particularly serious. Nevertheless, the future possibilities arising from the neglect of this affection are such as to call for the immediate adoption of all available means of control.

CAUSE OF THE DISEASE.

The take-all condition in New Zealand is characterized by the presence amongst typically affected wheat of a microscopic fungus comparable to, but in the incipient stages less evident than, the mould frequently growing upon stale bread. Under favourable environmental conditions, particularly those of warmth and dampness combined, this fungus is capable of vigorous growth upon wheat, of the production of spores (too small to be seen by the naked eye), and of spreading to other wheat-plants in the immediate vicinity. The scientific name of the fungus is *Ophiobolus graminis* Sacc., the characteristic fruiting or sporing structures of which have recently been definitely identified in New Zealand. (Figs. 1, 2, 3.)

Other fungi, some of which have not yet been reported in New Zealand, are said to produce like effects abroad, and in some parts of the world it has not yet been possible to attribute take-all to any specific organism. Seeing, however, that *Ophiobolus* is the fungus commonly associated with the take-all condition in New Zealand, and that it is widely and definitely accepted as the cause of take-all elsewhere, it is presumed that this fungus is parasitic, until such time as definite inoculation experiments shall have proved or disproved its pathogenicity in the Dominion.

EFFECTS.

At various stages in the growth of wheat the fungus penetrates, discolours, and disorganizes the tissues of the roots and of the culms at ground-level. At these parts, late in the season, it produces a blackish weft of mould-like growth, easily seen by the naked eye. (This "mould" remains on the stubble after harvest, giving rise to the spores that may infect succeeding wheat crops.) The fungus appears to hinder the flow of sap to the parts above, to arrest the growth, and to finally result in the death of the roots, culms, leaves, and ears, the last three bleaching a dull ashy white in the sun. Later the heads and even the rest of such plants may become bespattered as if with soot—the effect of another fungus common on dead wheat. In all cases the grains are diminutive, often entirely useless.

Affected plants occur commonly in roughly circular or oval patches. The patches are up to several yards in diameter, and consist, at about the end of January, of a thin crop of stunted dull-white or sooty-looking plants easily pulled out of the ground. The surrounding healthy crop is taller and of a bright-yellow colour in the straw. Again, affected and healthy plants may be intermixed and of similar height, the colour of the former readily distinguishing them.

SIMILAR EFFECTS FROM OTHER CAUSES.

The effects upon a wheat crop of "creeping" grasses, such as fawn (*Agrostis* spp.), twitch or couch (*Agropyron repens*), and creeping-fog (*Holcus mollis*), might possibly be confused with the general appearance of take-all injury. In many districts these grasses may be seen spreading thickly through the ground in more or less circular patches in which the wheat becomes stunted, the head being much smaller than usual. Unlike take-all patches, which consist of dead plants bleached white, the wheat in these weed-ridden patches at the end of last January was



FIG. 1. WHEAT-PLANTS AFFECTED BY TAKE-ALL.

Showing the dead roots and blackened condition of the fungus-ridden leaf-sheaths about the first internode of the culms. Specimens from Canterbury. Natural size.



FIG. 2. PART OF THE FIRST (LEFT-HAND) STEM IN FIG. 1, MAGNIFIED 10 DIAMETERS.

Showing minute black protrusions through the affected leaf-sheath. These are the necks of the perithecia or spore-producing structures of the fungus *Ophiobolus graminis*.

[Photos by E. B. Levy.]

usually green in the culm, leaves, and head, and grains of moderate size were formed. Wheat thus affected commonly remains greener than the surrounding unaffected crop, which at the same time will have more or less turned a bright yellow. This type of damage seems just as common at present as that caused by take-all.

Again, stunted wheat patches to be distinguished from take-all are to be found in depressions waterlogged after sowing, and on places said to be affected by grass-grub (*Odontria zealandica*). In all cases the occurrence of the dark "mould" at the base of the culm—particularly between the leaf-sheath and the culm—distinguishes towards the end of the season the take-all condition.

PERPETUATION AND SPREAD OF THE DISEASE.

No reliable information is at hand as to when and how take-all was introduced into New Zealand, but there seems little doubt that it has been in the Dominion for a number of years.

However profitable or unprofitable it may be, it is well known that in the absence of this fungus healthy wheat has frequently been produced on the same land for many years in succession. With weather conditions unfavourable to the fungus comparatively healthy wheat might even be raised on land previously carrying an infected crop. The presence, however, of but a small proportion of infected plants means that the fungus will remain in the field on the stubble after harvest. Here it will eventually produce its spores, any subsequent cultivation or trampling by stock serving as a means of distributing the disease—at least, within the same paddock. Hence, with moisture and temperature suitable to the fungus, a succeeding wheat crop would be much more affected than the previous one—in fact, might be a failure. All badly diseased plots recently examined in Canterbury had been preceded by one or more wheat crops, among which in most cases growers could recollect having observed the same but less pronounced symptoms of the disease. No instance could be found of the rapid spread of take-all from crop to crop through the air like "rust"—though to a comparatively very small extent this manner of spreading is not inconceivable; in fact, seed sown on uninfected land was seen to produce an unaffected crop even in places where such land adjoined an area carrying a badly infected crop. On the other hand, the planting of wheat on previously infected land resulted in the most serious damage that was met with, and, in my opinion, the perpetuation of the parasite is mainly due to this practice in dealing with infected areas.

It is difficult to say exactly how the fungus is transferred to previously uninfected land. Stock or the wind possibly carry infected fragments from one paddock to another; but, whatever the means may be, there is no doubt that certain plants other than wheat are capable of "nursing" the fungus should it be carried to areas that have never been devoted to this particular crop.

SUSCEPTIBILITY OF OTHER SPECIES.

The extent of information under this head is not very wide or conclusive. The following plants other than wheat are recorded as

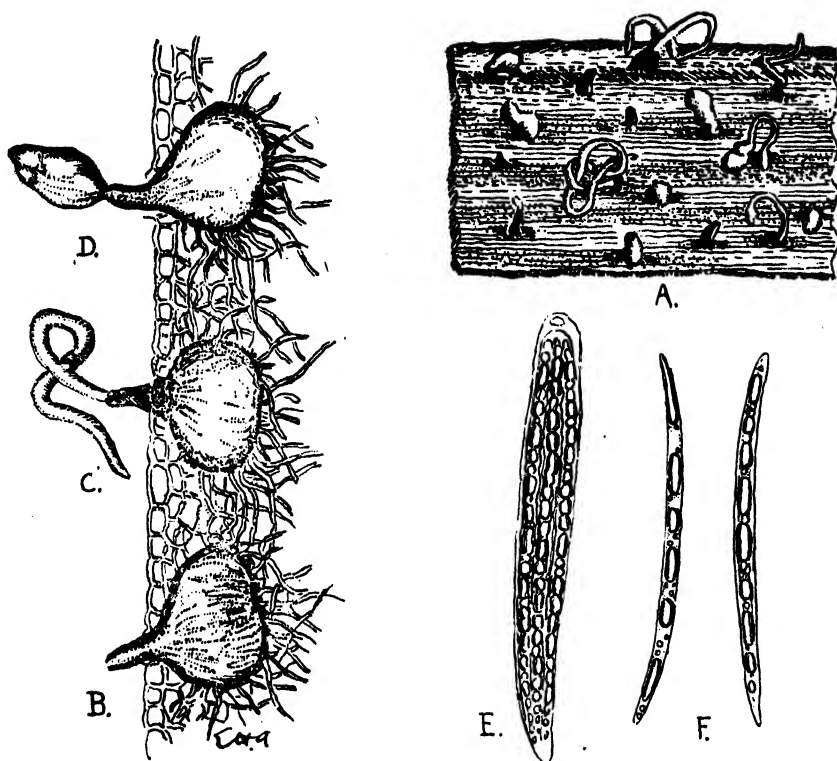


FIG. 3. DIAGRAMS OF FUNGUS *OPHIOBOLUS GRAMINIS*.

(A) Magnified somewhat over 60 diameters. Shows protruding through a portion of an affected leaf-sheath the necks of unripe perithecia and those of ripe perithecia, some expelling coils, and others masses of mucilaginous matter.

(B) More highly magnified. Showing a cross-section through an unripe perithecium. The body of the perithecium is immersed in the tissues of the leaf-sheath; about it, particularly at its base, are the threads of the fungus from which it arose, and within it is the mucilaginous matter, together with the asci or spore sacs, which later will be expelled through the neck that is shown protruding through the outermost tissues of the leaf-sheath.

(C) A similar cross-section, showing a coil of mucilaginous matter carrying the ascus through the neck of a ripe perithecium under comparatively dry conditions.

(D) A similar cross-section, showing a mass of mucilaginous matter bearing asci similarly expelled, but under moister atmospheric conditions, which soften the mucilage and prevent coil-formation. Much moisture dissolves the mucilage completely, distributing and liberating the asci.

(E) Very highly magnified. Shows an ascus separated from a mucilaginous coil by water. Within the ascus are the long filiform or threadlike spores, and at the top of the ascus the aperture through which the spores escape at maturity.

(F) Very highly magnified. Showing two spores which have escaped from an ascus. These are the reproductive bodies of the fungus *Ophiobolus graminis*.

[Diagrams by E. H. Atkinson.]

susceptible to the disease, and therefore as capable of perpetuating the fungus in infected land or of harbouring it on areas not devoted to wheat: Barley (*Hordeum sativum*); rye (*Secale cereale*); barley-grass (*Hordeum murinum*); brome-grass (*Bromus sterilis*); giant twitch, couch-grass, or spear-grass (*Agropyron repens*).

Red wheats, though not immune, are quoted as the most resistant kinds, while the earlier varieties are spoken of as the more susceptible.

METHODS OF CONTROL.

Various methods of combating take-all have been suggested:—

1. If by cutting the stubble longer, and, if necessary, by rolling it, a fire could be run over the ground a considerable proportion of the fungus and its spores would be destroyed. Infected land so treated would be much safer, but not entirely safe, for a succeeding wheat crop. Where there is no alternative than to grow another wheat crop on infected land this course might be adopted, together with late sowing, so as to avoid wet conditions, which favour the fungus. Deeper tillage would also assist in avoiding excessive soil-moisture. Wheat following a badly diseased crop is, however, a very doubtful proposition.

2. For the treatment of a few isolated patches in a paddock good results are reported from the recommendations of N. A. Cobb, of New South Wales, briefly as follows: Before harvest, when the disease is showing, mark the patches with stakes. After the harvest and before the following ploughing apply lime to these patches, at the rate of at least 1 ton per acre. As the disease is associated with excessive water in the soil the levelling-off of depressions in the ground and anything that can be done to improve the soil-drainage, such as deeper tillage, will be beneficial.

3. In considering a general line of treatment for larger areas the following points may be stated:—

(a.) Seeing that the fungus is retained on the land after harvest, and that its complete destruction by fire or by the application of a chemical compound may be impracticable, such methods as these should in general be employed, not as in themselves sufficient, but rather as subsidiary to other methods of control. Burning, where possible, in preparation for further treatment would therefore be a sound practice.

(b.) As, moreover, the fungus cannot be immediately destroyed in the soil, then the subsequent unhindered growth of wheat, barley, rye, barley-grass, brome-grass, or giant twitch would with suitable moisture and warmth probably serve to maintain, if not increase, the infection of the land. Susceptible plants must therefore be rigorously suppressed by cultivation or smothering, and any tendency to water-logging in the soil be anticipated by drainage or tillage.

(c.) As the parasite apparently depends for its existence upon the presence of a susceptible plant the complete destruction of such plants by fallowing long enough would eventually cause the fungus to perish for lack of sustenance. The cost of fallowing, however, would in most cases be prohibitive; the alternative, therefore, is a rotation of crops.

(d.) In the choice of a rotation any crop not known to be attacked may be selected, but especial preference given, where practicable, to oats and rape on account of their attributed immunity.

(e.) On land difficult to rid of twitch or other susceptible plants, prior to the establishment of temporary pasture, oats, rape, or other crop not subsequently cultivated, the use of a smothering-crop, such as autumn-sown oats and tares, is suggested.

(f.) Wheat would wisely be avoided in the rotation for at least two years.

(g.) There is a possibility of transferring the disease by means of stock, but several most valuable examples of healthy and badly diseased paddocks actually adjoining clearly show that healthy wheat can be produced on uninfected land even when it is adjacent to a badly infected paddock.

(h.) There is no positive evidence that the disease has been conveyed in the hairs of seed-wheat, nevertheless it would certainly be advisable to secure all seed from an undoubtedly healthy crop.

(i.) Straw stacks from badly infected areas are better destroyed by fire, more especially if there is no definite use for them.

LUCERNE-CROP COMPETITION.

THIS season a lucerne-crop competition was promoted by the Otakeho branch of the Farmers' Union, South Taranaki, in co-operation with the Fields Instruction Branch of the Department. The entries furnished particulars of the acreage, previous crop, seeding, date sown, manure, lime, and inoculated soil (if any). For judging purposes the scoring was arranged under the following headings: Freedom from weeds, evenness of crop, quality of crop, and colour and general appearance—a maximum of 10 points for each, or 40 in the aggregate.

On 31st January last the writer and Instructor Glasston judged the competition. There were six entries, and about twenty-five members of the union turned out in motor-cars and accompanied us over each field. After judging each crop the number of points awarded under each heading was announced, and we had a short discussion before proceeding to the next field. This was repeated on each farm visited, and altogether a very profitable day was spent. The winning crop gained 35 points out of the possible 40, while the others scored 30, 22, 21, 17, and 17 respectively. It may be mentioned that the winning crop was the oldest (some three years) among those entered, and was the only one in the competition to which inoculated soil had been applied at the time of sowing.—J. W. Deem, *Fields Instructor, Wanganui*.

Dufur Orchard.—The name of the large orchard in Oregon, referred to on page 112 of last month's *Journal*, is Dufur, not Deufar.

Limestones.—Samples of limestone recently tested by the Chemistry Section gave the following percentages of carbonate of lime: Wharekopae, Gisborne, 95; Marakanui, Central Otago, 93; Gladstone, Wairarapa, 90; Kara, North Auckland, 71; Martinborough, Wairarapa, 65; Hokianga, North Auckland, 62.

MILK AND CREAM FOR FACTORY SUPPLY.

THE PRODUCTION OF SOUND RAW MATERIAL.

G. M. VALENTINE, Dairy Instructor, Auckland.

PRACTICALLY speaking, the value of dairy-produce, especially butter, is determined by its flavour and keeping-quality, and both these points are almost entirely dependent on the state of the raw material when delivered to the factory.

It has been shown by experiment that milk drawn from a healthy cow, in perfectly clean surroundings, will keep for an indefinite period without material change if sealed up in a sterile vessel. While such conditions are not to be found on the average farm, the nearer they can be approached the better will be the condition of the milk produced. The most likely sources of contamination are dirty utensils, hands, or udders, and an impure atmosphere resulting from dirty sheds and dairies. Fully 90 per cent. of the defects in milk and cream are due to these causes, and neglect of cooling.

In the production of high-quality milk and cream four things are necessary—namely, a good set of brushes, plenty of boiling water, a good cooler, and, lastly, the inclination to use them.

Under present-day dairying conditions, where milking-machines and separators are in everyday use, quite a number of brushes are required if all the various parts connected with these machines are to be kept thoroughly clean. Without them it is impossible to get into the numerous corners where stale milk collects, with the result that each milking is inoculated by the germs which have developed since the previous one. Direct contact with dirty utensils is without doubt the most frequent cause of bad milk and cream.

The boiling-point of water at sea-level is 212° F., and no other temperature will do the same work. Hot water may be any temperature from just above blood-heat, which is quite suitable for washing utensils, but for scalding no temperature lower than boiling-point will give the same results.

The temperature at which milk is drawn from the cow is ideal for the development of the germs with which the atmosphere of even the cleanest shed is laden. By cooling the milk the growth of these germs is checked, and the development of bad flavours, which are the result of their action, is prevented.

Of the four requirements mentioned the last is the most important, as shown by the fact that where conditions are not of the best a liberal use of the first three may result in a good class of milk being produced. The labour entailed under such conditions is very much greater than where proper conveniences are provided, and as labour accounts for from one-third to one-half of the total cost of producing butterfat this aspect of the question cannot be ignored.

THE MILKING-SHED.

The advent of the milking-machine resulted in a complete change in the construction of sheds, as the new system called for much more rapid handling of the cows. As the first machines installed were bucket plants, milking two cows at once, the double bail was required, which was soon followed by the run-through shed, experience having shown that there was too much interference with the buckets when the cows had to back out of the bails. Practically speaking, there are only two styles of sheds being built to-day—the race shed and the run-through or half-race shed.

The race shed: In many districts the race shed has been almost generally adopted, one claim being that it is cheaper to build, and another that young heifers can be better handled than in a run-through shed. Provided the race shed is properly built, it is doubtful whether the first claim can be sustained. The floor-space in an eight-cow shed of this pattern is 30 ft. long by 15 ft. wide, including the gutters at each side. The floor-space for a run-through shed to hold the same number of cows is 29 ft. 6 in. by 15 ft.—practically the same. Very often the gutters are left out altogether in building the race shed, and the manure is shovelled out under the wall-plate on each side and left there indefinitely. The air coming into the shed passes over this heap, with the result that the whole atmosphere is impure. Even when proper gutters are provided it is the exception rather than the rule to find them kept as they should be. Taken as a whole, the race shed is more difficult to clean than the run-through, and for that reason the surrounding atmosphere is not as a rule so pure. If the lee side of the shed is built of rails instead of being close-boarded the result is much more satisfactory.

Dairymen who have had experience of both sheds claim that the race type is slower, as a hard cow in front will hold up the other three. The number of sheds which have been converted from race to run-through recently seems to bear out this claim.

The run-through shed: For a clean sanitary milking-shed which is easily kept in order and gives quick despatch in the handling of the herd the open-fronted run-through plan can be confidently recommended for either hand or machine milking. The plan shown on pages 148-9 makes provision for all the requirements which experience has shown to be necessary for the production of a first-class article, whether the milk is to be separated on the farm or delivered direct to the factory. The building is comparatively cheap, and any make of milking-machine can be installed satisfactorily. The cows go straight through, which reduces the wear on the floor, and if the doors are kept open between milkings a pure, sweet atmosphere is easily maintained. Every dairyman may not be in a position to carry out the whole plan as shown, but if the right lines are followed it may be possible to complete it at a later date.

SITE, DRAINAGE, AND WATER-SUPPLY.

The ideal site for a milking-shed is not available on every dairy farm, as several points have to be met in making the selection. The method often followed of erecting the shed as an addition to an existing

building is a bad one, as some essential feature has usually to be sacrificed. Stall feeding is not practised over the greater part of New Zealand, and consequently the close grouping of farm buildings is not necessary. The germ-laden atmosphere of the old-style farm-yard can be avoided, and the shed built in such a position that the milk is produced under the best possible conditions.

When the shed is built close to the rest of the farm buildings it very often happens that the fowls, pigs, and other farm-animals make free use of it between milkings. In this connection it is well to note that the Dairy Industry Act requires that pigs shall not be kept within 50 yards of a dairy, while no fowlhouse, manure-heap, cesspit, or closet shall be kept within 30 ft. The word "dairy" includes the shed and yard. On the other hand, it is a mistake to build the shed so far from the dwelling that proper attention cannot be paid to the stirring of milk and cream between milkings.

If possible, a dry level piece of ground with sufficient elevation to provide fall for drainage should be chosen. Should it be necessary to build the shed on a slope it is best to have the fall from the back of the shed to the yard, but abrupt slopes should be avoided if possible. Where the slope is from the shed to the yard it is best to excavate the shed-site to a firm bottom. Fillings are liable to sink and crack the concrete floor. A drain must be provided at the foot of the bank formed by the excavation, to carry off surface and storm water and prevent it running through the shed. Where the slope is in the opposite direction—that is, from the yard to the shed—a gutter will be required along the front of the building, otherwise the dirt from the yard will work down into the shed, especially if the yard is not concreted.

The practice of discharging drainage into a creek has several objectionable features. It is a waste of valuable manure, and, further, it will contaminate the water, which is probably being used by some one lower down. The water-supply of many dairy factories is drawn from open streams, so that a serious position might easily arise from this cause. A liquid-manure tank of concrete, or a portable one on a sledge, is much better.

An adequate and permanent water-supply is an absolute necessity in a dairy, and consequently this point must be considered in choosing a site. Where a gravitation supply is available it can be piped to the site which has the most advantages in other respects, but where the supply depends on pumping its source is of first importance. Defects in other respects can usually be got over, though it may cost a little more money, but a defective water-supply is a never-ending cause of expense and annoyance. A shed with a poor supply of water is usually a dirty one, and the milk received from it is consequently defective. A rain-water supply is seldom satisfactory, as it usually gives out just when it is most needed. Well-water is best, on account of its suitability for cooling milk and cream, but, failing that, a running stream is a good substitute.

In laying out the building the shed should be placed so that the prevailing wind will come from the back, or at an angle over the far corner of the separator-room. This will blow any smell from the shed or engine-exhaust away from the separator-room.

HAND-MILKING SHED FOR DIRECT SUPPLY.

The following is a detailed list of the material required for the shed, yard, and race only, for hand milking, in which case the 6 ft. passage shown on the complete plan can be used for washing-up purposes.

Shed and Passage.

Concrete, 11 yards. (Aggregate: Sand and shingle, 12 yards; cement, 54 standard bags.)

Timber—

Plates, 4 x 2—2/10, 2/15, 1/6; studs, 4 x 2—8/9; rafters, 4 x 2	Ft.
—10/16; rails, 4 x 2—8/13	262
Studs, 4 x 3—16/8	128
Studs, 4 x 4—5/8, 5/9, 3/10	154
Plates, 6 x 3—2/15, 1/7	56
Purlins, 3 x 2—5/19, 5/17; rail, 3 x 2—2/15; bars, 3 x 2—8/10;	
plates, 3 x 2—4/15	175
Rails, 6 x 2—6/11	66
Boarding, 9 x 1 (weatherboards, barges, doors, &c.)	700

Total 1,541

Rafters set over each post and one between, about 3 ft. 6 in. apart.

Ledged doors (8) with pivot hinges and fasteners, and bar with two notches for "open" and "shut." Chains, 8 pieces of $\frac{3}{4}$ in. chain, 4 ft. long, with strong hooks and eyes. One pair of ledged doors with hinges and fasteners. One gate 5 ft. wide with hinges and fasteners.

Nails, 30 lb. of 3 in. and 20 lb. of 2 in.

Galvanized corrugated iron, 20 sheets 9 ft. long, and 20 sheets 8 ft. Lead-head nails, 15 lb. Ridging, 40 ft. 16 in. wide, lead-edged one side.

Yard.

10 yards concrete (12 yards sand-shingle and 54 bags cement).

Race.

4 yards concrete (5 yards sand-shingle and 23 bags cement).

Posts, rails, and large gates are not included in these quantities.

MACHINE-MILKING SHED FOR DIRECT SUPPLY.

For a shed in which machines are to be installed, but no separator is required, the engine and pump will, of course, be put into the room in which the separator is shown on the plan. The quantities required for this room are:—

Concrete, 3 yards. (Aggregate: Sand and shingle, 4 yards; cement, 18 bags.)

Timber—

Plates, 4 x 2—4/13, 2/9; studs, 4 x 2—12/9, 12/8; trimmers,	Ft.
4 x 2—1/9; rafters, 4 x 2—4/20	242
Purlins, 3 x 2—4/13	26
Anglebores, 4 x 1—4/9; 3 x 1—4/9; scribes, 3 x $\frac{1}{2}$ —8/9	39
Boarding, 9 x 1 (weatherboards, barges, doors, &c.)	600

907

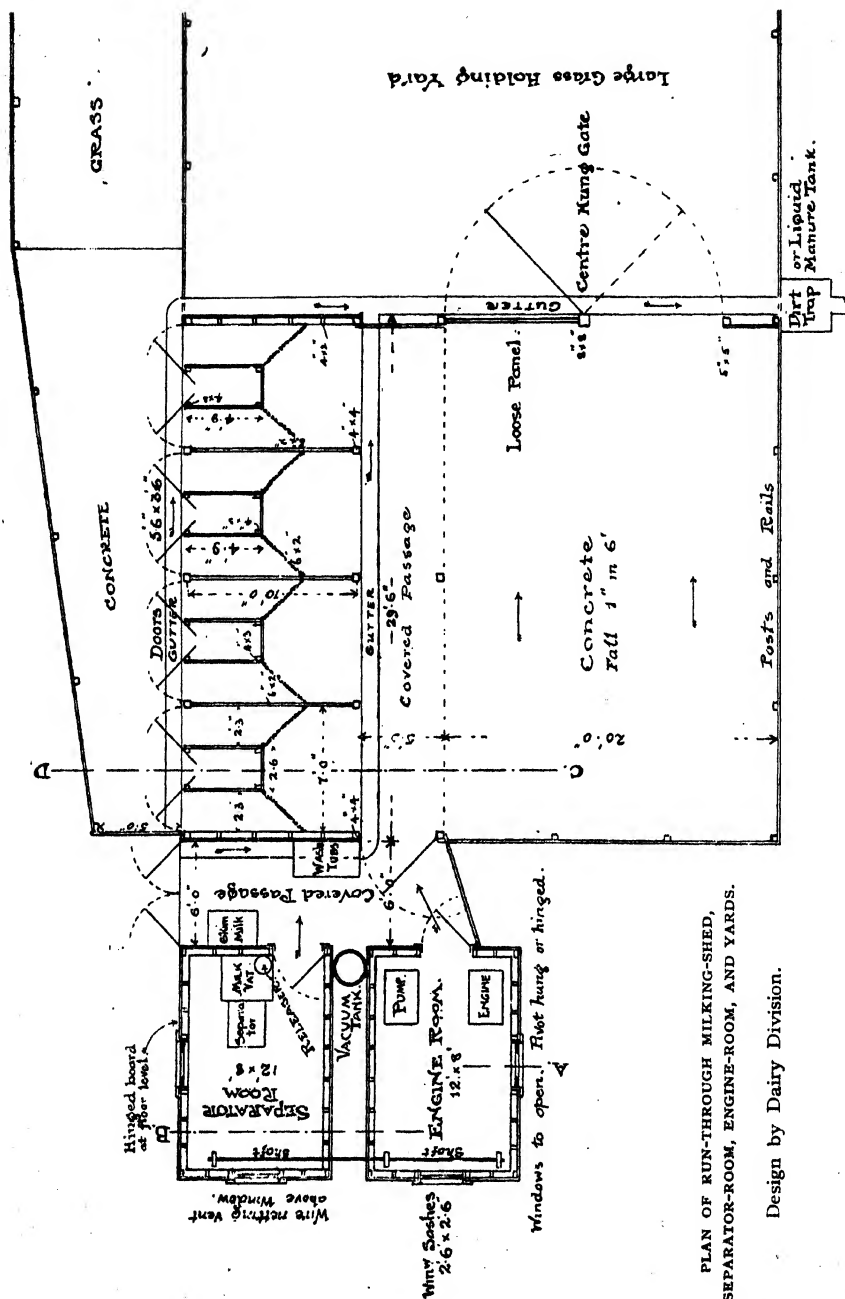
Rafters to be about 3 ft. 6 in. apart.

Two window-frames, with external architraves, stops, and scribes, &c., complete; two sashes (4 light)—2 ft. 6 in. by 2 ft. 6 in.—glazed with 16 oz. glass, with fastenings, &c.

One ledged door, with external architraves, linings, and fasteners complete.

Nails, 30 lb. of 3 in. and 20 lb. of 2 in.

Galvanized corrugated iron, 8 sheets 9 ft. long and 8 sheets 8 ft. Ridging, 13 ft. of 16 in. lead-edged on one side. Lead-head nails, 12 lb.



In this case it is assumed that the shed will be carried on the full 15 ft. wide. If that is done it will be better to have the door of the engine-room in the side instead of in the end of the room as shown. The releaser can be erected in the 6 ft. passage between the engine-room and the shed. The covered space in front of the engine-room can then be used for washing-up, &c. Where a milking plant with automatic release and pulsation is to be installed a small saving can be made by building the engine-room across the shed, at right angles to the position shown. With a mechanical pulsation this is not so suitable, as it necessitates an angle drive.

HAND-MILKING SHED FOR HOME SEPARATION.

In a hand-milking shed for home separation the separator-room may also be placed at right angles to the position shown in the plan. For hand separation a room 8 ft. wide by 10 ft. long is quite big enough, and as this will leave a covered way nearly 5 ft. wide in front of the separator-room a 2 ft. air-space between the shed and room will be sufficient. This will further reduce the amount of material required.

MACHINE-MILKING SHED FOR HOME SEPARATION.

For the carrying-out of the complete plan as shown it will be necessary to add the same amount of timber required for the engine-room to the quantities already given, and also about 2 yards of concrete and eight 6 ft. sheets of iron. Concrete for the foundations of the engine and pump is not included in the estimates, as the amount required will vary with the type of machine installed. It may be found that there are some "unders" or "overs" in the quantities here given, due to the fact that they are progressive estimates, but they are approximately correct.

POINTS IN DESIGN AND ARRANGEMENT.

In the plan certain principles are embodied which are essential and which cannot be omitted without spoiling the whole thing, as they are the result of careful investigation on the farm into certain defects found in milk and cream received at the factories. Other points may be altered to suit the circumstances, which will vary with almost every case.

Among the essentials may be mentioned the provision for air-spaces. Frequently the defects mentioned have been found to be the result of the practice of building the separator-room on to the end of the shed with only a partition between. In many cases the partition is not even carried up to the roof, and even when it is there is a door in it, which for convenience during milking is kept open. If the shed is wet and dirty the smell is carried into the separator-room and absorbed by the cream. In a dirty dry shed, in addition to the smell, a fine dust is raised by the cows, which gets directly into the milk and cream, and is one of the causes of fermented cream and gassy cheese.

Exhaust flavour is the result of the engine being in the same room as the separator or releaser, more especially where a kerosene-engine

with a blow-lamp attached is in use. Occasionally a shed is met with where the engine exhausts into the separator-room, and frequently the piston-rings have worn to such an extent that the fumes escape into the room at each explosion. Such a room soon becomes saturated with the smell, which is very penetrating and can be detected several paces from the shed. Naturally cream held for two days in such an atmosphere absorbs the taint, but even the fresh morning's cream or milk will be affected. Instances are on record where a wind blowing from the engine to the separator gave this flavour to the cream, and with a change of wind the flavour disappeared. The same flavour will be imparted to the milk if the releaser is delivering it into open chutes which pass through the engine-room on the way to the milk-stand.

In some cases the circumstances may be such that the separator and engine-rooms have to be put at the opposite end of the shed to that shown. If so, the holding-yard and race must also be reversed. The object of this arrangement is to secure a clean atmosphere, free from dust, round the separator-room. If the cows are handled at that end this is impossible, as the large holding-yard, nominally of grass, is more frequently mud in wet weather and dust in dry weather. For the same reason the rest of the farm-animals should be prevented from wandering round the dairy, as it frequently results in buckets of milk being upset and the whole surrounding atmosphere polluted.

For this same reason the passage between the shed and rooms is made 6 ft. wide. In many otherwise well-conducted dairies there is no provision made for handling the skim-milk, and the whole surroundings are contaminated by skim-milk froth being spilt about. If the plan given is followed a tank can be provided with a tap to draw off the skim-milk for calf-feeding. The froth can then be dealt with and the tank washed out with very little labour, thus doing away with one of the common sources of smell round a separator-room. There is also room for wash-up tubs, discharging into a proper drain—another point which is frequently neglected.

The object of the spreading race is to prevent a "boss" cow cornering a timid one, which she has more chance of doing in an ordinary straight race. By fencing the race and discharging the cows at the end there is not the same difficulty in keeping the step-off in order, as the length of front is reduced.

Dwarf walls are provided under all wall-plates. Not only will the life of the plates be lengthened by this means, but the drainage cannot run over and leak through the bottom weatherboard. In the same way concrete is drawn up round each shed-post.

Quite a number of sheds are spoiled by having the gutters made too deep and narrow, with square edges. Wide, shallow gutters with rounded edges are much better, as they are much more easily kept cleaned, and the cows are not liable to slip off the edges and cause a splash. A gutter with sloping sides and level bottom may be preferred, and it is as good as the one shown.

Coming to optional points, the drainage may be carried off at either side of the yard or to the back of the shed if the slope of the ground makes it necessary. It is not advisable, however, to carry it through the passage between the separator room and shed. If placed

where shown 4 in. pipes are required at the gateways. The liquid-manure tank should be placed 30 ft. from the shed.

Pivoted doors are provided, as they have the advantage of being better balanced, and when left open between milkings the whole of the back of the shed is open to the sun and wind. Some users place the opening-lever on the opposite end of the door to that shown, but there is sometimes a difficulty in getting enough leverage to open or shut them if there is a strong wind blowing. Others prefer the 2 ft. 3 in. doors all opening either to right or left.

Some erectors may prefer to place the engine in the far corner of the separator-room in a line with the pump, and drive from the engine to the pump and thence to the shaft. This will require less shafting, but, on the other hand, there are three belts instead of two to transmit the power from the engine to the separator, and consequently more likelihood of a loss in speed through the belts slipping. The direct drive from the engine to the shaft is better where a saw is to be driven. No objection can be taken to a saw being driven off a pulley placed on the shaft in the air-space between the two rooms, but the practice of driving the chaffcutter, shearing-machine, &c., with the same engine usually results in each job being done badly.

Where the milk is to be separated it is advisable to wrap a piece of hair-felt round the milk-pipe in the passage, to keep in the heat. This can be easily removed when the pipe is taken down for washing.

The exhaust-pipe of the engine should discharge into the atmosphere near the top of the wall on the side farthest from where the milk is being handled. If the water from the roof is being used for washing the utensils it should not discharge over the iron. Exhaust flavour has been frequently traced to this cause.

Storm-doors are provided at the end of the passage, one or both of which can be shut if rough cold weather is experienced from that quarter. For the same reason the ventilating-board at the floor-level in the separator-room is hinged. This should always be kept open between milkings. By leaving out a board or two over the window and inserting bird-netting plenty of ventilation will be secured, and the current of air entering at the bottom opening will dry the floor and prevent the development of a damp smell.

The most important part of a milking-shed is the floor, and for this purpose concrete is easily the best material which has so far been found. Wooden floors are not nearly so satisfactory, and in many districts they cost more to put down and do not last so long as concrete. Even a well-laid floor of sawn timber cannot be kept thoroughly sanitary, as the wood absorbs and subsequently gives off many odours. Such floors are also more difficult to wash down, and when wet they are very slippery.

Slab floors are an abomination, as it is almost impossible to put them down in such a manner as to prevent them leaking, the result being an accumulation of filth underneath, which is a source of smell and a breeding-ground for flies. Moreover, the uneven surface makes it impossible to keep them clean. Gravel or metal floors are not satisfactory, and should be looked upon only as temporary substitutes for something better. They soon become foul, and are constantly breaking up and needing repairs.

Some details regarding concrete-work for the floor are given farther on.

In the construction of the building the lean-to roof has been adopted on account of cheapness. A ridge roof may be preferred, but it will be more expensive if the shed is to be used for horse separation, on account of the extra width at the engine-room end. Boards and battens may be used instead of weatherboards, in which case the framing will have to be altered to suit. In one respect this is an improvement, as it presents a plain surface for lime-washing, and the lime does not run through and show on the outside of the wall.

If vertical boarding is decided upon a very nice finish can be given to the separator-room by using flooring-boards instead of boards and battens. By putting the dressed side to the inside of the room a smooth surface is obtained which is easily kept clean. If an old-style separator with high stand is to be put in it may be necessary to have the separator and engine-room about 1 ft. lower than the shed, to get the necessary fall from the releaser. An alternative is to have a rise in the milk-pipe from the bails up to the releaser, but this is bad practice. Owing to the surging of the milk in the pipes a quantity of butterfat is churned and collects in the releaser. This is a source of loss and makes the releaser very hard to wash.

Another plan was to sink the frame of the separator into the concrete, which caused trouble with the running, on account of it being too rigid. With the new style of stand, which is made in two pieces, this may be done, as the vibration can be taken up at the joint by putting in a piece of rubber packing. Where a low-stand separator is used a glazed earthenware pipe set into the floor and filled with concrete makes the best separator-block, being easily kept clean. A wooden or concrete block soon gets saturated with oil, gives an oily smell to the whole room, and looks unsightly.

For the milk-tank a bracket nailed to the wall is better than a stand, as there are no legs in the way when scrubbing down the floor. A very simple bracket can be made by nailing a couple of battens to the wall under the milk-tank and hanging them to the roof with iron rods. The fewer the wooden fittings round a separator the better. To this bracket a chute can be hung to carry the skim-milk to the tank in the passage outside. A tank 54 in. long, 30 in. wide, and 18 in. deep will hold approximately 100 gallons of skim-milk.

Where milk is delivered direct to the factory the releaser should be placed in the passage between the engine-room and the shed. From the releaser it can be carried by a covered chute to the milk-stand and then passed over a cooler into the cans. Copper chutes with a water-jacket are now largely used, but are not so efficient as the corrugated vertical cooler. If there is sufficient fall in the ground the floor of the stand can be kept up to wagon-height, but on a flat site the cans will be on the ground-level. It is a simple matter, however, to arrange a post and lever to hoist the cans into the wagon. Assuming that the prevailing wind is from the back of the shed the milk-stand should be placed about 30 ft. away in that direction. If a chute is used to convey the milk it will then be well out of the way and have no doorways to cross. A plank to stand on when washing this chute is necessary.

CONCRETE-WORK FOR THE FLOOR.

If well laid in the first instance concrete can be looked upon as a permanent floor, but it must be remembered that it is only as strong as the material from which it is made. For instance, floors made of burnt clay, scoria, shells, or pumice will not have the wearing-qualities of hard metal and sharp sand. It will also require a greater proportion of cement in mixing. For these reasons it may be actually cheaper to spend a little more money in procuring suitable gravel in the first instance, besides getting a floor which will last a good deal longer after it is put down.

The depth of concrete necessary to make a satisfactory floor will depend upon the material from which it is made and the nature of the foundation. On a good hard bottom 3 in. to 4 in. of good concrete may be quite sufficient, but if the ground is soft or has been filled in, 6 in., as shown in the plan, will be required. The depth of concrete and the proportion of cement used will, of course, make a difference in the cost of the shed. In allowing for the quantities given in the specifications the worst conditions likely to be met with have been kept in mind.

A mixture of four of gravel to one of cement by measurement is allowed for, but that again will depend on the nature of the materials used. Where good, clean, water-washed river-gravel or hand-broken metal and sharp sand is used a poorer mixture will give good results. The best concrete is made from gravel which is evenly graded from coarse sand up to stones $1\frac{1}{2}$ in. square, or from broken stone and sand similarly graded.

To test for dirt rub the wet gravel between the hands, which will be soiled if earth is present. If so, it will be necessary to wash the gravel before it is used until the water runs clear. If there is any doubt about the materials it is a good plan to mix a small quantity of concrete in the correct proportions and place it in a mould to set, which will show whether it is suitable.

In mixing the object to be arrived at is to give each particle of sand or stone a coating of cement, and unless this is properly done the result will be a poor floor which will break up in patches. More depends on the way in which the turning is done than on the number of times it is done. To take a shovelful and turn it over is no use. It must be given a sweeping motion, from left to right, or *vice versa*, as though the gravel was being spread. Two men with shovels and one man with a coarse rake form a combination which gives good results. When thoroughly done the mixture should have an even, or what a buttermaker would call a straight, colour all through. A watering-can or a hose with rose attached is the best means of adding the water, turning to be then continued until the colour is straight. When finished the concrete should be so wet that, to use a successful concrete worker's expression, "you can find water in it"—that is to say, that if it is left to stand in a bucket water will collect on the surface. A great many more floors are spoiled by the concrete being mixed too dry than by it being mixed too wet.

When laying the floor, put the wet concrete down and ram it until the water and finer parts of the mixture are worked up to the surface, then trowel it off to a fairly smooth face. A plaster finish for either

factory or shed floors has proved a failure, as more often than not the plaster cracks and lifts off. Wire netting laid in the concrete will considerably add to the strength of the floor.

It must be remembered that a yard of gravel and sand and a quarter of a yard of cement mixed will not make a yard of concrete. For this reason considerably more gravel is allowed for in the specifications than the amount of concrete required.

Any one who has not previously done concrete-work would be well advised to engage the services of an experienced man if such is to be had. Nothing is more annoying than to go to the expense of putting down what was expected to be a permanent job and then find that it will not stand. A fault in any other part of the building can usually be rectified at almost any time, but a bad floor cannot be repaired until the following off season, and even then it is difficult to get a thoroughly satisfactory result. When competent assistance is not obtainable the foregoing hints may be of some value.

A BUSINESS PROPOSITION.

A properly equipped shed on a dairy farm is a sound business proposition, as the cost of milking is a question which must be taken more and more into consideration with the rise in wages. Take one item alone—washing-up and the cleaning of the shed. If through want of proper appliances, poor water-supply, or a bad floor it takes one man half an hour longer daily to do the work, the cost per year at rs. an hour is £9 2s. 6d. This would pay interest on £150 worth of improvements. With improved conditions obtaining in other avenues the amount of labour offering for the farm must decrease in proportion unless the work is made more attractive. Even where no outside labour is employed the expenditure on a good shed is well repaid in comfort to the milkers. Then there is the question of quality of the milk or cream, which must not be lost sight of, and which is so much more easily maintained in a well-equipped shed than in an inferior one.

(To be continued.)

NOTE.—Larger copies of the plans reproduced on pages 148 and 149 may be obtained on application to the Director of the Dairy Division, Wellington, or to any officer of the Division. Where possible Instructors will also advise on the laying-out of dairies if application is made for assistance.

ADVICE TO FARMERS ON LIME-DEVELOPMENT.

A COMMITTEE of Government experts, consisting of the Chemist to the Department of Agriculture, the Director of the Geological Survey, and the Assistant Engineer-in-Chief of the Public Works Department, has been formed to advise groups of farmers requiring information concerning the erection of limeworks, limestone-crushing machinery, and related matter. Inquiries may be addressed to the Chemist, Department of Agriculture, P.O. Box 40, Wellington.

FIRE - BLIGHT.

A SERIOUS DISEASE OF FRUIT-TREES.

A. H. COCKAYNE, Biologist.

IN December last alarming reports were published in various newspapers in the Dominion concerning a new fruit-tree disease that had appeared in the Auckland Province. Officers of the Horticulture Division and Biology Section have made a complete investigation into this outbreak, and the disease has been fully proved to be the dreaded American fire-blight, a bacterial disease caused by an organism known as *Bacillus amylovorus* Burr. In North America fire-blight has caused probably more loss than any other single fruit-tree disease. Unless adequately controlled in the Dominion it is liable to prove disastrous to our fruitgrowing interests, especially as it is particularly prone to attack apples and pears. To a limited extent it is also known to infect certain stone-fruits, more particularly apricots and cherries, but it is on pip-fruit that its ravages are rightly dreaded, and it is just on this class of fruit that the future of our orchard development depends.

Fortunately, at the present time fire-blight appears to be confined to the Waikato, with outlying areas of infection in the Tauranga district and the outskirts of Auckland south of that city. It is essential that every effort should be made to eradicate the disease, so as to avoid its distribution into the main fruitgrowing sections of the Dominion. Once well established in the main pip-fruit districts it might well be only the matter of a year or two before the whole of our fruitgrowing industry would be seriously menaced.

The control of fire-blight is difficult inasmuch as spraying is of no avail, and the only method to adopt lies along the line of complete removal of all diseased portions of the affected tree. The main period of infection is in the late spring and early summer, when flower and shoot infection occurs. This is followed by a period of comparative quiescence of the organism, which winters over in cankered areas on the branches of the trees, followed again by rapid growth and fresh infection in the following year. Flower-infection is extremely serious, as it causes complete destruction of the crop.

Both flower and shoot infection can be prevented by systematic removal of all infected wood prior to the blossoming-period. All infected shoots, and laterals, &c., carrying infected flower-buds, should be cut away at least 1 ft. below the apparent infection. Where the grower is desirous of saving any large limbs bearing cankers he should remove the cankered areas with a sharp knife, cutting well outside the affected area. All knives, seccateurs, &c., used should be sterilized at each cut, which will prevent the further spread of the disease by such tools. The wounds left after cutting over should be sterilized with a 5-per-cent. solution of formalin, lysol, or similar disinfectant, and then coated with a dressing of coal-tar.

An extremely important point to remember is that the disease can winter over in branches that have been cut from the tree, so that the immediate burning of all prunings and cut-out cankers is essential. The systematic removal of all affected wood is a slow and tedious process, but the orchardist has the whole of the late autumn and winter (the quiescent period of the organism) in which to carry out the work.

A full account of the life-history and control of fire-blight is under preparation, and will be published in the *Journal* in the near future.

NOTE.—The subject of fire-blight is also dealt with in "The Orchard" monthly notes later in this issue.—EDITOR.

LIMESTONE AND LIME.

MINERALOGY, TESTING, AND SAMPLING.

Extracts from "THE LIMESTONE AND PHOSPHATE RESOURCES OF NEW ZEALAND": Geological Survey Bulletin No. 22, Part I, 1919, by P. G. MORGAN, Director, assisted by officers of the Survey.

LIME-BEARING MINERALS.

CARBONATE of lime occurs in two distinct mineral forms, alike in chemical composition but physically different. These two forms are known to the mineralogist as calcite and aragonite. There may also be other forms of calcium carbonate.

Aragonite forms hard parts of reef-building corals, the shells of gasteropods, and the inner pearly layers of bivalve shells, but is otherwise a somewhat uncommon mineral of little importance as a source of lime. Authoritative information concerning aragonite in organic structures is difficult to obtain, and it is somewhat doubtful how far it does or does not enter into the composition of shells, corals, &c.

Calcite, on the other hand, is a very abundant mineral, widely distributed through the earth's crust. There are numerous varieties, differing considerably in general appearance. All the varieties are characteristically of a light colour, but the presence of impurities may cause variations in tint from white or transparent to black. For the purposes of the present publication the chief forms in which carbonate of lime occurs may be enumerated and described as follows:—

(1.) Pure or nearly pure *calcite*, occurring in more or less perfect crystals, and then known as dog-tooth spar, nailhead spar, &c. Iceland spar is a perfectly transparent form.

(2.) Carbonate of lime, occurring in the form of *calcareous concretions*, which are usually very fine-grained and tough, but as a rule are not of great purity. Concretions are small masses of mineral substances which have collected round a nucleus. The nucleus may be a grain of some mineral other than that forming the mass of the concretion, a piece of vegetable matter, or it may be merely the point at which the concretion has begun to form. The late Alexander McKay's felicitous definition of a concretion may here be quoted: "A concretion is some-

thing that has gathered itself round about something else ; sometimes there is nothing for it to gather about, but that does not prevent its being a concretion all the same, only there is no foreign substance in its heart."* Calcareous concretions occur in many forms—globular, ovoid, kidney-shaped, cylindrical, disk-like, dumb-bell shaped, or wholly irregular. They are common in claystone and the allied rocks, which in New Zealand are often called "papa." Calcareous concretionary bands or layers, usually very tough and impure, are not uncommon also in the calcareous claystones of this country.

(3.) *Massive limestone*, occurring in beds or layers. Such material forms the principal subject of this bulletin. Argillaceous or hydraulic limestone is an impure sub-variety, containing a considerable amount of clayey matter. As the clay increases, the rock grades into calcareous claystone. Arenaceous limestone is a limestone containing a considerable proportion of sandy matter. With an increase of the sand to, say, 50 per cent. arenaceous limestones become calcareous sandstones. Shelly limestone is a limestone composed very largely of visible fragments of shells. Some of the so-called shelly limestones of this country contain numerous pebbles, and are rather to be called shelly or calcareous conglomerates.

(4.) *Marble* is a highly crystallized altered limestone, suitable for ornamental use. The coarser-grained marbles are sometimes called crystalline limestones.

(5.) *Chalk* is a soft easily disintegrated variety of limestone, formed chiefly from the remains of the minute organisms known as Foraminifera.

(6.) *Coral-rock* is formed principally of the remains of corals.

(7.) *Calcareous marl* is a soft earthy deposit, formed chiefly in fresh-water lakes by the accumulation of the remains of calcareous algæ, fresh-water shells, &c. It grades into ordinary marl, which is simply a notably calcareous claystone.

(8.) *Stalactite* and *stalagmite* are materials formed in caves or under overhanging rocks by the deposition of carbonate of lime from water that has percolated through limestone or other calcareous rock. Moisture excluded, they are usually practically pure carbonate of lime.

(9.) *Calc-sinter*, *calcareous tufa* or *tuff*, and *travertine* are names applied to one and the same thing—namely, carbonate of lime deposited by springs or, more rarely, by streams.

(10.) In New Zealand *shells* form a somewhat important source of carbonate of lime. As a rule, they consist of almost pure calcium carbonate, either in the form of calcite or of aragonite. A few shells are highly phosphatic. The shells of crustacea are more phosphatic than those of ordinary shell-fish. As already indicated, corals, Bryozoa, Foraminifera, and some algæ are also important sources of carbonate of lime ; and their remains, together with those of Mollusca (shell-fish), form the great bulk of the world's limestones.

Immense amounts of carbonate of lime exist in less pure forms than those enumerated above. If the percentage of carbonate of lime falls below 85 the limestone, as already explained, may be called "arenaceous" or "argillaceous," according to whether sand or clay is the

* "On the Prospects of finding Coal on Rowley's Farm, near Shag Point Railway-station." Rep. of Geol. Explor. during 1890-91, No. 21, 1892, p. 48.

chief impurity. Calcareous claystones, sandstones, and conglomerates are very common in New Zealand. The rock, or rather group of rocks, popularly called "papa" has a widespread distribution in both North and South Islands. Though in general only slightly or moderately calcareous, "papa" in places approaches or becomes argillaceous limestone. There are many rocks which, as first formed, contain lime only in the form of silicate, but by alteration come to contain several per cent. of carbonate of lime. In rare cases carbonate of lime in the form of calcite is an original constituent of igneous rocks.

Dolomite is a mineral composed of carbonate of lime and carbonate of magnesia, with possibly other carbonates. Typical dolomite, if pure, contains 54.35 per cent. of carbonate of lime and 45.65 per cent. of carbonate of magnesia. The union of the two substances is probably analogous to that of two metals in an alloy (especially such an alloy as Muntz metal) rather than to a strict chemical combination, such as that of calcium, carbon, and oxygen in carbonate of lime. It is not analogous to an ordinary mixture, because dolomite has a definite crystalline form and definite physical properties of its own. Dolomite forms the main constituent of extensive rock-masses in various parts of the world. Limestones with a moderate percentage of magnesia are not uncommon, and are termed dolomitic or magnesian limestones. Such rocks on microscopic examination are found to be mixtures of dolomite, calcite, and other minerals.

Various other minerals containing more or less carbonate of lime need not be mentioned here. There are, however, many minerals which contain a proportion of lime in the form not of carbonate, but of silicate. The chief of these are various varieties of feldspar, augite, and garnet. In addition there are two important mineral substances of which lime is one of the principal constituents. These are gypsum and phosphate of lime.

Gypsum is hydrated sulphate of lime, and is represented by the symbol $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$. Varieties of it are known as satin-spar, alabaster, and selenite.

Several phosphates of lime, differing somewhat in chemical composition, and each having its own name, are known to the chemist. In ordinary usage the name "phosphate of lime" is applied to tricalcic calcium phosphate, with the symbol $\text{Ca}_3\text{P}_2\text{O}_8$. This substance does not occur pure in nature, but forms the essential constituent of the minerals apatite, phosphorite or collophane, and ordinary phosphate rock. It is also the most important constituent of green bones, and may be considered to form the whole of bone-ash, impurities excepted.

There are two varieties of apatite—*fluor-apatite*, with the composition represented by the compound symbol $3\text{Ca}_3\text{P}_2\text{O}_8 \cdot \text{CaF}_2$; and *chlor-apatite*, represented symbolically by $3\text{Ca}_3\text{P}_2\text{O}_8 \cdot \text{CaCl}_2$. "Phosphorite" and various other names have been applied to the form of phosphate of lime that forms the bulk of ordinary phosphate rock. Undoubtedly the mineral here present is an amorphous substance which has combined with it a small amount of carbonate of lime. Austin F. Rogers* proposes that the old name of "collophane" should be applied and restricted to this mineral.

* "A Review of the Amorphous Minerals" *Journal of Geology*, Vol. 25, No. 6, Sept.-Oct., 1917, pp. 530 *et seq.*

TESTS FOR LIME AND LIMESTONE.

The simplest test for limestone or any other form of carbonate of lime consists in the application of any of the ordinary acids (in liquid form). If carbonate of lime is present numerous bubbles of gas will form. This gas is no other than the carbon dioxide (CO_2) already mentioned as the substance driven off from limestone by heating strongly.

The most satisfactory acids for general use are nitric acid (spirits of hartshorn) or hydrochloric acid (spirits of salt) diluted with one or two parts of water. Good vinegar will answer quite well. It is not generally known that various solid acids, such as tartaric and citric, can be used by placing a tiny pinch of the powdered material upon the stone together with a drop or two of water.

Ordinary limestone gives off gas quite freely when cold acid is applied, but fine-grained hard calcareous concretions, especially if magnesian, may effervesce very slowly unless powdered and gently heated. Dolomite is hardly affected by cold acids, but if it is powdered and gently heated brisk effervescence soon begins.

It will be observed that the acid test is for carbon dioxide rather than lime, but in practice this test, combined with the general appearance of the stone being tried, is quite sufficient. For full information regarding tests for lime and its various compounds the reader must be referred to works on chemistry and mineralogy, or to teachers of those subjects.

If a small piece of fairly pure limestone is placed in a glass or porcelain dish (say, an ordinary saucer) and covered with some acid in liquid form (preferably dilute nitric or hydrochloric) it will be seen that the fragment of stone as it effervesces diminishes in size, and after a short time breaks up and practically disappears, except that a little sand will be left in the dish or other vessel used. The effervescence ceases, the carbon dioxide of the limestone having now escaped, while the calcium oxide or lime formerly combined with it has united with the acid to form a new substance (calcium nitrate or chloride, according to the acid used), into the exact nature of which it is not necessary here to enter. A stone which, though it effervesces freely, does not break up when treated with acid is of poor quality, and is useless for the manufacture of quicklime.

The object of describing the above experiment is to show the reader how he may roughly ascertain the quality of a sample of limestone—namely, by comparing the residue after acid treatment with the original material. For this purpose the following directions may be given:—

Reduce what is considered an average sample of the limestone to a fine powder in any convenient way. The lumps may be broken into small pieces with a hammer on an anvil or on a hard flat stone, and then crushed to powder by placing them between two folds of brown paper and striking with the hammer. An iron pestle and mortar, if available, will, of course, be found much better than the brown paper and hammer. A very small sample may be powdered by pressure between two large coins. Take as much of the powdered limestone as will lie on a sixpence, place it in a saucer, dampen it with water, and then add a few drops of semi-dilute nitric or hydrochloric acid (one part of water by measure to one part of acid as bought from the

chemist or drug-manufacturer). When effervescence ceases add two or three more drops of acid to make sure that all the carbonate of lime has dissolved, then gently pour off the acid or most of it, and compare the bulk of the sandy residue with that of the powdered limestone that may be conveniently placed on a sixpence. If there is clayey matter in the limestone the comparison will not be very satisfactory, because it will be impossible to decant the acid off the residue left after treatment without some loss. Should the residue, however, be sandy, and clearly less than one-tenth the bulk of the limestone taken for the test, then the limestone is of good quality.

If the powdered limestone taken for the test is weighed on a chemical balance, and the residue after acid treatment with aid of heat is transferred to a filter-paper, washed with pure water, dried, collected (preferably after igniting—that is, strongly heating the material and burning the filter-paper to an ash), and weighed, the difference of the two weights, due allowance being made for the ash of the filter-paper when this has been ignited, represents with a moderate degree of accuracy the amount of carbonate of lime in the stone, plus any other carbonate, such as that of magnesia or iron, that may be present. The result thus obtained, however, is usually too high, because some of the silicates present will almost certainly have gone partly into solution. The weight of the residue left after acid treatment, reduced to a percentage of the weight of limestone taken, is the “insoluble” of some analyses.

SAMPLING LIMESTONE.

The operation of sampling a substance with a view to making an analysis is most important, for if the sample is not properly taken the analyst's skill and time will be wholly or largely wasted. The complete analysis of a rock takes days of the chemist's time; it is therefore irrational, in most cases at least, to spend only minutes in taking the sample. The sampling of an agricultural limestone need not be so elaborate as when the stone is to be used in the manufacture of glass or in certain other chemical industries, but it will be admitted that the more carefully the work is done the better. Hitherto in New Zealand the samples of limestone and of many other substances collected in the field have consisted of single lumps (which may be called fortuitous or “grab” samples), or of a few pieces of stone broken here and there from the deposit, so as to form as representative a sample as the collector knew how to obtain under the particular circumstances. Such samples may be termed “empirical” samples, and represent most of the samples collected by the Geological Survey in the course of its ordinary work.

Concerning the types of samples termed above “grab” and “empirical,” Orton and Peppel write: “Experiment has shown that it is difficult, if not impossible, for any person to select a sample without bias, even where not interested in the result, if he is acquainted with the effect of his actions in putting in or rejecting portions.”* This statement is somewhat unhappily worded, for it may be construed to imply that the less a person knows the more likely he is to select a

* Orton, Edward, and Peppel, S. V.: “The Limestone Resources and the Lime Industry in Ohio.” Geol. Surv. of Ohio, 4th Series, Bull. No. 4, 1906, p. 26.

true sample, nor does it differentiate between the grab sample and the empirical. The meaning, however, is this: An interested person—for example, a prospector—is hardly able to resist the temptation of putting a large proportion of the best-looking material in his sample, instead of selecting average-looking material. Some men, perhaps with the best intentions, select nothing but the best material, and then persuade themselves that they have collected average samples. On the other hand, a person with a judicial temperament, if possessed of the requisite technical knowledge, and keenly interested in obtaining a true average sample—for example, a mine-manager or a battery-superintendent—may be trusted to select samples that on the whole will yield an average result, with possibly a slight error one way or the other, due to the personal equation.

The sampling of limestone and other nearly homogeneous substances does not present the same difficulty as the sampling of variable material such as auriferous quartz. In the case of limestone to be used for agricultural purposes only, the method of collecting empirical samples by chipping off average-looking fragments with hammer and chisel will give good results in the hands of an experienced person; and even an inexperienced person, by taking pains, employing common-sense, and resisting the temptation to select the best material, ought to obtain fairly representative samples. In this method of sampling the following points have to be observed:—

(1.) In the case of an unworked limestone deposit the places to be sampled ought to be selected with a view to access and convenience of working.

(2.) The limestone outcrop ought to be carefully observed, with a view to determining whether it is fairly uniform in quality from top to bottom.

(3.) If the limestone stratum is thick, and especially if the different layers show want of uniformity, it must be divided into sections of measured thickness.

(4.) The material to form the sample ought to be selected along lines at right angles to the plane of the deposit—that is, along lines that measure the thickness. Such lines will be at right angles both to strike and dip.* It is true the latter condition need not be exactly fulfilled, but the nearer one can approach to it the better.

* Sedimentary rocks generally show distinctly that they are formed of a number of layers, one superimposed on another, like the leaves of a book. Each distinct layer forms a bed or stratum (plural, "strata"). The terms "bed" and "stratum" are very often extended in meaning to include the whole mass of one kind of rock, particularly when the parting-planes between the various layers are not very distinct. "Stratification" and "bedding" are abstract nouns referring to the arrangement of rocks in strata. We speak of "horizontal stratification" when the beds lie level, "inclined stratification" when the beds are tilted or folded, and so on. "Strike" is a horizontal line drawn in an inclined bed or on a fault-plane, or it may be defined as the line of outcrop on a perfectly level surface. In practice the word "strike" generally means the direction of the horizontal line as defined above, as measured at some particular point, but it is no doubt more exact to speak of the direction of the strike. "Dip" is the inclination of a bed or fault-surface, &c., from the horizontal. The term is generally used so as to mean direction of inclination from the horizontal. The direction of dip of a stratum is always at right angles to the strike-direction.

(5.) In sampling the various sections care must be taken to select a proper proportion of each kind of material, as nearly as can be judged by the eye. Thus if the stone is partly hard and partly soft a due proportion of hard rock must be selected. If there are argillaceous, arenaceous, or greensandy layers present, a fair amount of the impure material must be taken. The inexperienced or non-judicial sampler is very apt to neglect this point.

(6.) If the outcrop is large, samples should be selected along several lines, duly divided into such sections as necessary, and spaced at equal distances from one another.

(7.) Careful notes concerning the locality of each sample, and the thickness and class of stone it represents, should be taken.

(8.) Each sample should be carefully labelled and placed with its label in a stout canvas bag, which also should be labelled or numbered.

(9.) The analyst should be given full particulars concerning the locality of the deposit, and such other information as may seem desirable or be asked for. Do not send him single lumps of stone or carelessly selected samples. Do not be so foolish as to attempt to mislead him as to the locality or nature of the deposit. Those who misinform or deceive the analyst are bound to be the losers in the long-run.

Quartering down.—In general a sample of limestone if properly taken will be too large to send by parcel-post to the analyst. It can safely be reduced in size by the method of quartering down. This consists in breaking all large pieces of stone to a small size—say, that of hazel-nuts or smaller—mixing the sample well, and piling it on a flat smooth surface in a somewhat low conical heap, which is then carefully spread out in a circle. The material is then divided into four quarters by drawing two narrow channels at right angles through the centre of the material. Two opposite quarters are then removed, and the operations of mixing, piling, spreading out, and quartering repeated. If a small sample is desired the lumps must be broken still smaller before quartering is repeated. The best procedure of all is to reduce the whole sample to a coarse powder before quartering down, but in the field this is not practicable.

Quartering down may also be employed where duplicate samples are required. The method of obtaining supposed duplicates by breaking a single lump in half, or of dividing a rough sample in two by picking out a few lumps, need only be mentioned to be condemned; yet there are frequent cases where persons have used this method, and have been surprised when the analyses of the two samples did not agree. Quite commonly the analyst is blamed for his lack of skill. If two analysts have been employed, the one who gets the lower results will get the credit of being unskilful or ignorant. As a matter of fact, an inexperienced sampler will obtain concordant duplicate samples only by accident.

Quarry sampling.—Where a quarry has been opened the facilities for sampling are generally better than in the case of ordinary outcrops. If only one or two general samples are desired the broken rock may be sampled, but usually it is better to sample the rock-faces in sections, as described above. When a rock-breaker is at work it is feasible to obtain a good average sample from the material passing through the

machine, care being taken to select proper proportions of coarse and fine. The sample, which should be large and selected at intervals, may then be broken and quartered down as described. If a fine-grinding machine forms part of the equipment, as in a limestone-pulverizing plant or cement-mill, no difficulty need be experienced in getting good average samples.

Systematic sampling.—The ideal method of securing true samples of a hard deposit is to bore it from top to bottom with a diamond drill, and save all the core. If the deposit is soft it may be bored in some other way, and all the drillings saved for analysis. Alternating hard and soft layers will prevent thoroughly representative samples of the whole being obtained by drilling methods. The usual method of sampling an exposed face of rock or mineral is to cut a uniform groove from top to bottom, and save all the cuttings. The face, if high, and especially if heterogeneous in composition, is divided into sections. An experienced sampler will alter his methods according to circumstances; but the following details, mainly quoted or paraphrased from Orton and Peppel,* illustrate the general methods of systematically sampling an outcrop or quarry-face:—

(1.) The sample should be cut from the strata in place rather than taken from the stock pile of the quarry. The latter is liable to fluctuate from hour to hour, as the product of one stratum or horizon happens to form its surface layer, as may be the case after a large shot is fired. Very often it is not possible to tell whether the pile of debris at the foot of the face is representative of the whole face or not.

(2.) The part to be cut should be first well cleaned from top to bottom by sweeping with a broom or brush.

(3.) A large canvas sheet (one 9 ft. square was used by Orton and Peppel) should be spread close under the place selected, so that the cuttings will fall and be collected on the sheet.

(4.) A groove, uniform in width (2 in. or 3 in.) and in depth (1 in., 2 in., or 3 in.), should be cut from top to bottom of the face to be sampled. The tools used may consist of a blacksmith's hammer of about 4 lb. weight, one or two cold-chisels mounted on handles, and a few heavy stone-cutters, gads, &c. It is desirable that the groove should be cut in a straight line from top to bottom of the section sampled; but if this is impracticable, then by following the edges of bedding-planes, and collecting from different strata in one small area, a full cross-section of the limestone may be obtained. When on account of the nature of the rock being sampled, or its location at great height requiring climbing and working with scant footing, a groove cannot be cut, the canvas may be removed from the foot of the face and large lumps of rock broken out of the various layers. From each of these a section of the proper size may be dressed.

Where narrow strips of shale, greensand, or other impurity occur, these should be carefully cut to the proper section, and all the cut material allowed to drop on the sampling-sheet. If the impure bands are wide it is better in some cases to sample them separately. The width, of course, must be carefully measured.

* Orton, Edward, and Peppel, S. V.: *loc. cit.*, pp. 27, 28.

(5.) All the cuttings should be saved on the sheet, but pieces of stone known to be accidentally dislodged from points adjacent to the groove should be rejected.

(6.) The total weight of the sample may range from 5 lb. to 150 lb. In special cases it may be greater. Apparently Orton and Peppel, as a rule, took only one sample of a high quarry-face. It would be better in many cases to divide the face into measured sections and take several samples.

(7.) Every sample should be labelled plainly and legibly with a number and other particulars inside and outside of the sack in which it is placed. The inside number may be written or cut on a piece of soft wood and then wrapped in cloth. Whatever the method, care should be taken that the marking cannot be obliterated or the label lost.

(8.) If the sample is taken from a stock pile, bins, rock-breaker, or any unusual source, all the circumstances should be noted.

(9.) Every detail of the sampling and every observation of the material sampled should be noted at the time the sample is taken. The entries in the notebook used should be clearly worded and legibly written. Abbreviations should be sparingly used.

Orton and Peppel give further details, which need not be quoted, of how the main sample, by crushing and quartering, is reduced to the small sample of about $\frac{1}{2}$ lb. weight used by the analyst for his work.

As previously stated, for agricultural purposes limestone need not be sampled in quite so elaborate a manner as that just described, but for some industries sampling of that kind is very necessary. In reconnaissance work and in general geological survey it is usually impracticable to take samples by the method of cutting a continuous groove. Provided the geologist or other explorer has experience, skill, and a knowledge of the general principles of sampling, he can without much difficulty select empirical samples that are representative of the locality sampled; but during the preliminary examinations it is generally not feasible to take all the samples that may be required for a thorough knowledge of the deposit, the expense and time involved in such work being usually prohibitive. It may be added that where a deposit is being worked on a large scale, and small variations in quality do not matter, numerous empirical samples may safely take the place of a smaller number of systematic samples.

Sunshine for Young Pigs.—Sunlight is indispensable for the health and vigour of newly born pigs, except in extremely hot weather. The sooner they get the sunshine the better it is for them, and farrowing-houses fitted with windows and doors to let in the sunshine are decidedly advantageous. As soon as the little pigs are strong enough to run around and follow the sow they may be let outdoors into the sunshine, provided the weather is favourable. They should be able to do this within three days to a week. Sunlight and exercise make strong pigs in the early stages of their life.—K. W. Gorringe, *Instructor in Swine Husbandry*.

NATURAL COOL-AIR FRUIT-STORAGE.

SOME AMERICAN SYSTEMS.

J. A. CAMPBELL, Assistant Director, Horticulture Division.

NATURAL cool-air storage (as distinguished from mechanical refrigeration) is very largely utilized in many parts of the United States of America, and although the systems vary somewhat the difference is not very great in the more recently constructed houses. The object sought in each case is, of course, to reduce the temperature of the house by admitting air when the atmosphere outside the house is colder than the air within, and to maintain for a maximum length of time the low temperature thereby secured.

To attain these results satisfactorily an ample free air-circulation must be available, and the walls, ceiling, and roof of the building must be specially constructed. In southern California the earlier citrus storage was built on the partial basement plan—that is, the floor of the house was some 4 ft. or 5 ft. below the ground-level. The building itself was practically a house within a house, some 6 in. to 12 in. space being left between the two walls, and similarly with the roof. A number of fairly wide doors set opposite each other in each set of walls provided the bottom ventilation, while the top ventilation was through an opening along the ridge of the roof. Such houses were and are still giving great satisfaction in the curing of lemons and the storage of citrus fruits.

The more recently constructed houses, however, are on a somewhat different plan. Underground ventilation by means of concrete tunnels is provided. In this case top ventilation is provided, but it is not so important, as the object of the tunnels is to provide a means whereby the whole of the air in a room may be drawn off by fans and replaced with fresh cold air in a comparatively short time.

The general plan adopted, however, for the storage of deciduous fruits is either the hollow or the insulated wall, with or without a basement. In the Yakima and Wenatchee districts the hollow wall with basement is the common method, while in Spokane the basement has been dispensed with, and the walls are insulated. The objection made to the basement lies in the added difficulties of ventilation, while it is claimed that any advantage gained by having the building partially underground is covered by insulating the walls.

The following description covers a two-story building with insulated walls and without basement :—

Foundation : Outer foundation solid concrete, 2 ft. to 2 ft. 5 in. high. Inner foundation concrete blocks 6 in. high and 1 ft. square, set in every 10 ft. with wooden blocks sufficient to bring the inner foundations on a level with the outer.

Floor : 10 in. by 2 in. floor-joists are set on the foundation, and the floor, which is 3 ft. to 3 ft. 6 in. above the ground, is made of 4 in. by 2 in. timber with a $\frac{1}{2}$ in. space between each board. The joists are set in across the building. It is held that the floor would be better if it were made the height of the bottom of a fruit-wagon.

Bottom ventilation: The ventilators are 1 ft. 6 in. by 3 ft., and are constructed on the plan of a cold-storage door. They are set in lengthwise in the outer foundations, 14 ft. 6 in. from centre to centre.

Walls: Studs 8 in. by 2 in. These are boarded on the inside with what is in America termed "shiplap"; ordinary lining-boards would do. The same material is put on the outside, and the space between rammed firmly with shavings and sawdust. Next comes a covering of building-paper, and then the weatherboarding.

Roof: 4 in. by 2 in. rafters are used for the roof. These are lined above and below with the shiplap and covered with ruberoid or similar material. The space between is filled with shavings and sawdust. If it is desired to make two separate storerooms the ceiling should be insulated in the same manner as the roof. In the house being described, however, the upper floor did not come within 8 ft. of either wall, owing to the slope of the roof, and the whole of the building was held at the same temperature.

Upper ventilation: If the upper and lower rooms are not held for separate storage, louver ventilators set in the apex of the roof are sufficient. These are about 3 ft. wide, and are so arranged as to provide approximately the same outlet as the intake provided by the bottom ventilators; but in arranging it is necessary that one should be set in at either end of the chamber and one in the centre. The upper ventilators are fitted with trap-doors that can be readily let down when required.

In the case of two separate chambers being run, two sets of bottom ventilators must be provided. The second set is in the outer walls immediately above the second floor. Separate upper ventilation must also be provided, so that the hot air from the chamber below may be carried off without contaminating that of the upper one. This is done by cutting a 1 ft. 6 in. by 3 ft. (or larger) hole in the ceiling at either end of the building, and boxing it in with timber, making a kind of flue up to an opening in the apex of the roof. This is also done in the centre as frequently as circumstances make it necessary, according to the size of the building.

Two separate chambers are rarely run other than in basement buildings. In this case bottom ventilation must be dealt with in much the same way, boxing being provided inside the chamber to carry the cold air, coming through the ventilator, down under the floor. Each ventilator must be treated in the same way. All other matters pertaining to a basement store are the same as those already described. Ventilators in the foundation must be set in opposite each other.

The hollow walls referred to are mainly constructed of hollow tiles, but some are on the system described minus the insulation. In this case, however, a further dead-air space is recommended, and is provided by putting 3 in. by 2 in. timber outside the building-paper, covering the wall again with lining and a further coat of building-paper, then finishing off with weatherboarding.

Although natural cool-air storage is, as previously stated, very popular in the United States, it is doubtful whether the same success would obtain under the milder climatic conditions of New Zealand. In the north-west States particularly the summer is very hot, but the season is short, and well before the apple crop is harvested the nights become cold and more or less frosty, thus simplifying the question of reducing the temperature in the store by means of night ventilation.

WEEDS AND THEIR IDENTIFICATION.

(Continued.)

ESMOND ATKINSON, Biological Laboratory.

PERENNIAL SOW-THISTLE (*SONCHUS ARVENSIS*).

THERE are many plants among those naturalized in New Zealand which in their native countries are of little importance, but which have become aggressive here; while, on the other hand, several plants known elsewhere as most objectionable weeds, though they have been observed in the Dominion for a number of years, have not hitherto proved particularly dangerous in this country. Among these may be mentioned the subject of this article, perennial sow-thistle (*Sonchus arvensis*), which is also known by the names corn sow-thistle and creeping sow-thistle.

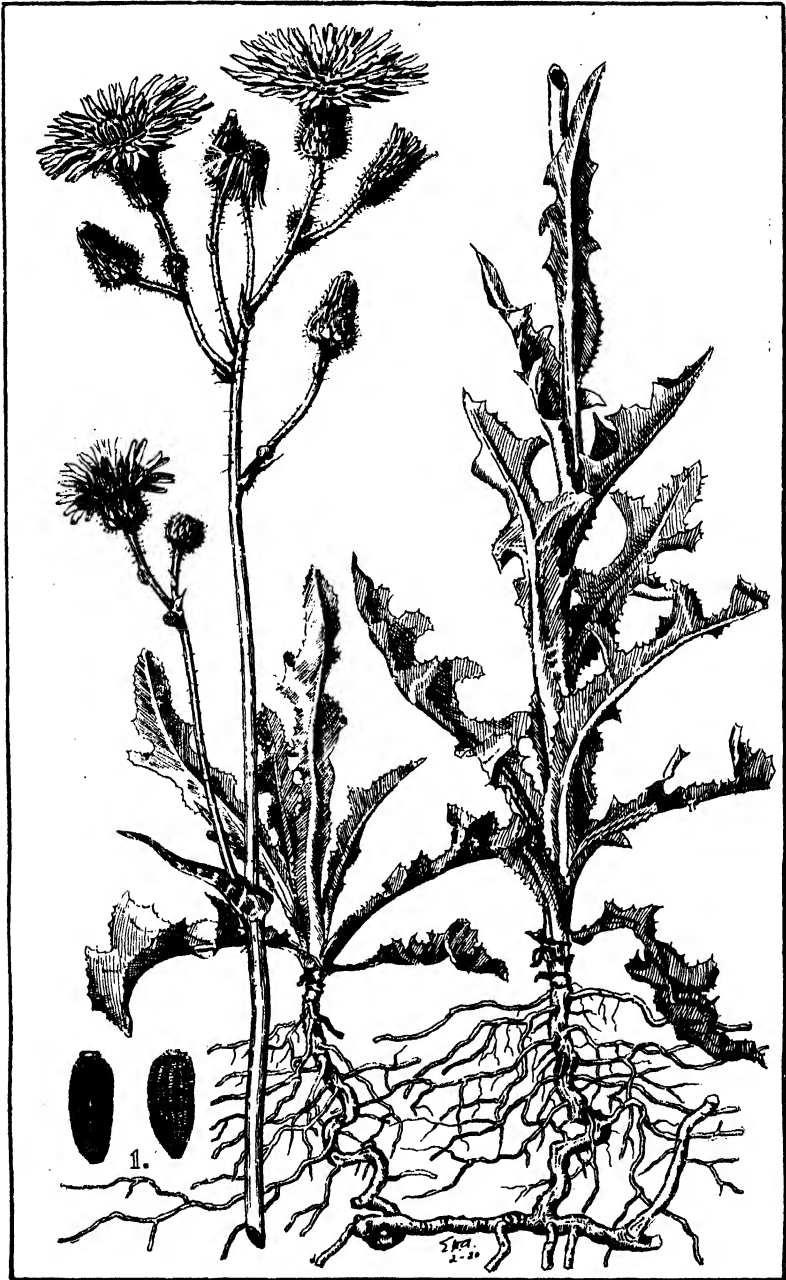
Perennial sow-thistle is a bad weed in England and in many parts of Europe (its native habitat), and in parts of Canada it is looked upon as the worst of all weed pests. While it does not follow from this that perennial sow-thistle may ever reach a position of first importance among weeds in New Zealand, it is already extremely troublesome under certain conditions.

As regards distribution in the Dominion, perennial sow-thistle was first recorded from Auckland many years ago, and has since been noted in several parts of the Manawatu district, and in Canterbury and Southland. Beyond these broad facts not much is known of its distribution, and further details on this point would be welcome.

DESCRIPTION.

Perennial sow-thistle is a tall plant, reaching the height of 3 ft. or 4 ft. It is, as a rule, much more slender than either of the two common sow-thistles (*Sonchus oleraceus* and *S. asper*), and the stem is only slightly branched; but it is in the root-system that the greatest difference is to be seen, for in the species now under consideration there is a thick wide-spreading horizontal rootstock which throws up leafy shoots at frequent intervals. In general appearance this root-system is not unlike that of Californian thistle, but it differs in being shallower, the horizontal rootstock often being not more than 4 in. or so below the surface of the soil. The whole plant is full of a bitter milky juice.

The leaves are crowded round the lower part of the stem, but become fewer towards its top, so that the part below the flower-heads is practically leafless. The root-leaves are the largest, being 6 in. or more in length; they are frequently less deeply lobed than the lower stem-leaves, but otherwise resemble them closely. The lobes of all the leaves are irregularly placed, often much twisted, and as a rule their tips tend to point towards the base of the leaf. The lower leaves,



PERENNIAL SOW-THISTLE (*SONCHUS ARVENSIS*), HALF NATURAL SIZE.

1. Achenes, or "seeds," magnified about 6 diameters.

in addition to the large indentations, have their margins toothed with small soft spines, but this character is absent from the upper leaves.

The flower-heads are borne in a loose spreading cluster at the top of the stem; in large specimens, or in those in which the top has been cut off, long stalks bearing smaller clusters of heads often arise from the axils of the upper leaves. The heads themselves are quite different in appearance from those of the common sow-thistles; they are far larger (up to 2 in. in diameter) and brighter yellow in colour, and have much the look of heads of dandelion or catsear.

The involucre (the ring of green bracts from which the yellow rays spring) varies in shape according to the age of the head; in the bud it is rounded with a flattened top, in the mature flower-head more or less cylindrical, and in the young fruiting-stage conical. As the fruit ripens and the feathery pappus spreads out the involucre bracts become reflexed and lie back against the stalk. All these stages are shown in the illustration. In the common New Zealand form of the plant the involucre and the stalks below them are covered with light-coloured glandular hairs—that is, hairs provided at their tips with minute knobs which secrete a sticky substance. There is, however, another form of the plant in which no hairs whatever are found.

The achenes, or “seeds,” average about $\frac{1}{16}$ in. in length by $\frac{1}{32}$ in. in breadth, and are of a dull dark-reddish-brown colour. In shape they are roughly oblong and slightly flattened, and at one end bear a light-coloured crown, which marks the point of attachment of the pappus. The achenes are longitudinally marked with strong ridges, one on each edge and five on each side, the middle ridge and those at the sides being the most prominent, while in addition the whole surface is covered with deep transverse wrinkles.

SIGNIFICANCE AS A WEED, AND CONTROL METHODS.

In New Zealand perennial sow-thistle is harmful only as a weed of cultivated land, where its strongly developed root-system and its large production of seed render it very aggressive. The ordinary processes of cultivation, unless they are merely preliminaries to further control work, will only have the effect of breaking up the rootstocks into pieces and, since a small piece is capable of producing a new plant, of further distributing the weed.

I am indebted to Mr. J. Beverley, Plant-breeder, Central Development Farm, Weraroa, for an account of some experiments carried out by him with a smothering-crop of Weraroa vetchling, a species of *Lathyrus*, closely allied to the Tangier pea (*L. tingitanus*). Part of an area occupied by the sow-thistle was sown down on 7th May, 1919, with the vetchling, which came away well and made a fine growth, and when on 24th January last it was harvested for seed there was no sign of the weed on the surface. One small plant has since appeared, but there is no doubt that in the main the use of the smothering-crop has been effective. Another part of the same thistle-infested area was laid down in grass in 1917, and, except for a few scattered plants none of which are more than 1 ft. from the edge, all trace of the weed has disappeared. Sheep will eat perennial sow-thistle readily, and this fact, together with the results of the smothering-

crop and grassing experiments referred to, which indicate that a well-aerated soil is essential to the plant, shows that as a weed of pastures it is negligible, and that there is no danger of it spreading from cultivated land to land where there is a good sole of grass.

Perennial sow-thistle is thus an excellent example of a plant which under a certain set of agricultural conditions may be a most serious pest, while under different conditions, in places perhaps only a few yards away, it may disappear entirely from the ranks of weeds. An intelligent study of its behaviour under these different conditions should go far to disabuse those people who consider that the significance of any particular plant as a weed is one of its intrinsic characters instead of one which is supplied by environment. This is the fundamental fact on which all efforts at weed-control should be based (though this is far from being the case in practice), and if it were thoroughly realized no weed-control legislation would really be required.

The control methods against perennial sow-thistle where cultivated land has become badly infested may be summed up as follows, two courses being open : (1) The land should be laid down in grass ; or, (2) where this is impracticable, some smothering-crop, such as that mentioned, or tares and oats, should be used, if necessary for two years in succession. The planting of potatoes, which are so often looked upon as a good cleaning-crop, is not to be recommended, as the aeration which they give the soil allows the underground stems of the thistle to last through the season.

The achenes of perennial sow-thistle are occasionally found as impurities in commercial lines of seeds, particularly in imported alsike and timothy, but they are of much rarer occurrence than those of the two annual sow-thistles.

Qualities of a Herd Boar.—The qualities and characteristics of a herd boar are matters of the greatest importance. Every pig-breeder should know and have fixed in his mind just what qualifications to require in the animal that is to head his herd. A sow directly affects only the pigs she farrows, while the boar affects every litter in the herd. The most important qualities required in a boar are : Good, big bone ; well grown ; a long, wide, deep body ; a level back, with short neck and head ; a wide, deep, roomy chest, low hams, short legs, and standing well on his feet ; fairly large ears, wide between eyes, good colour, fine hair, good action, gentle disposition, yet showing strong masculine qualities and vigour ; from a good family which is prepotent, prolific, and has quick feeding-qualities. If the sows are weak in certain qualities it is well that the boar be strong in those qualities. The breeder should always keep in mind an ideal of the best type of conformation, and try to improve his herd by mating such animals as will come nearest to bringing about that ideal. Remember that it is the best cuts and the highest quality of dressed pork or bacon that is the ultimate object, and not points of the show-ring.—K. W. Gorringer, *Instructor in Swine Husbandry*.

RADIO-ACTIVE FERTILIZERS AND PLANT-GROWTH.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

THE influence of radio-active ores applied as fertilizers is now attracting some attention in the northern part of the Dominion, owing to the claims of some fertilizer-vendors in attributing radio-active properties to their products. It may therefore be of interest to review investigations which have been conducted on this subject in England and other countries. In the December, 1915, issue of the *Agricultural Gazette of New South Wales* the following notes appeared :—

For some little time past the question of applying radio-active ores to the soil with a view to increasing plant-production has been receiving considerable attention in England. Among the experimenters in this direction is Mr. Martin H. F. Sutton, of Reading, who last year carried out a series of tests. These have been continued during the current year, and in September last a large party of scientists and others inspected the results of the second year's work. The visitors were impressed with the complete character of the investigation, and the provision made against error. The results examined were even more emphatic than those of 1914, in showing that "while in some cases plants dressed with radio-active ore had given better results than the control plants, the improvement had not been of such a nature as to warrant the assumption that so expensive a commodity as radium could be profitably applied to crops."

A series of field trials was also conducted at the University of Illinois during the seasons 1913-14, with the object of testing the effects of radio-active fertilizers as crop stimulants. The conclusion arrived at was that as long as the present prices prevail the use of radium fertilizers cannot prove an economic possibility.

Mr. Sutton's investigations are again referred to in the November, 1916, issue of the same publication, as follows :—

In 1914 the crops experimented on were radishes, lettuces, peas, and flowering annuals, and germination tests were made on seeds of rape, red clover, and smooth-stalked meadow-grass. The objects of the experiments were to ascertain—(1) Whether radio-activity has a harmful or beneficial effect upon plant-life; (2) whether, if beneficial, strong or weak dressings of radio-active ore should be employed; (3) whether radio-active material can be used with advantage to accelerate germination.

The general conclusion arrived at from these experiments was that they afforded some evidence that radium possesses the property of developing and increasing growth, but the cost of the ore far outweighed the worth of the additional crop. The experiments indicate that a light dressing is likely to give as good results as a heavy one. The germinating tests were not always consistent, but tests made with radio-active ore did not generally prove superior to the controls in which no radio-active material was used.

The experiments were continued in 1915 on tomatoes, potatoes, radishes, lettuces, onions, carrots, vegetable marrows, spinach, and beets—crops selected because of the widely varying character of the produce—fruit, roots, foliage, and bulbs. Nine different radio-active materials were tested, including pure radium bromide, pitch-blende concentrates, ores, mine residues, radio-active sands, and proprietary fertilizers said to be radio-active.

Experiments were also carried out to test the effect of radio-active material on the germination of seeds.

The general conclusions arrived at by Mr. Sutton are that the experiments indicate no more hope of the successful employment of radium as an aid to either horticulture or agriculture than did the trials carried out in 1914.

A great number of experiments have been conducted in different countries on various crops, and, so far as is ascertainable, wherever the experiments have been carried out under strict and comparable conditions the use of radio-active material has produced only negative results. Of local interest are the results of Victorian experiments. Dr. Ewart, of Melbourne University, as the result of experiments carried out on wheat (Journal Dept. Agric., Victoria, Vol. x, p. 417, 1912), concludes that "there is nothing in these results to show that radio-active mineral is of the least benefit to wheat when applied in the same manner as manure."

The Bureau of Soils, Washington (Bulletin of the U.S. Department of Agriculture, No. 149, by W. H. Ross), summarizes a number of such experiments from the United States, England, France, and Victoria on a variety of crops, all pointing to the same conclusion. Mr. Ross comes to the conclusion, among others, that it seems incredible that radium or any of its products can have any economical application as a fertilizer in general farming. He also points out that the average radium-content in an acre-foot of soil is about 3.6 milligrammes. The radium present in 1 ton of radio-active mineral containing 2 per cent. uranium oxide amounts to 5 milligrammes. So that in order to double the amount of radium in an acre-foot of soil there would be required about three-quarters of a ton of such ore, costing about £16 per ton.

In England, Mr. Sutton's investigations were followed up by trials at the Woburn Experimental Station. The following table is extracted from page 19 of the "Report of Pot Culture Experiments, Woburn Experimental Station," 1917:—

Table XIII.—Radio-active Ore on Wheat, 1916.

	Average Length of Ear.	Average Length of Straw.	Percentage Weight.	
			Corn.	Straw.
	In.	In.		
No treatment	2.77	25.11	100	100
Radio-active ore 5 cwt. per acre ..	2.55	24.76	92.5	93.1
Radio-active ore 10 cwt. per acre..	2.45	22.17	94.6	91.3
Radio-active ore 1 ton per acre ..	2.45	22.61	93.2	92.4

It would not appear, therefore, from this experiment that there was any advantage whatever accruing in the yield of wheat from the application of the ore.

Montane Tussock-grassland Investigation: A Correction.—On page 90 of last month's *Journal* barley-grass (*Hordeum murinum*) was included in a list of species noted in the experimental tree-planting area on the Sugarloaf, near Lowburn. This was a slip for soft brome-grass (*Bromus hordeaceus*).

Hemp-grading.—A grading-store for the examination of hemp, tow, and stripper-slips has been established at Wairoa, Hawke's Bay, in the premises occupied by the New Zealand Shipping Company.

HERD-TESTING ASSOCIATIONS.

THE PART OF THE DAIRY DIVISION.

W. M. SINGLETON, Assistant Director, Dairy Division.

THE testing of dairy herds for production is increasing in popularity, and as a result more of this work has been undertaken by the Dairy Division during the present season than hitherto has been the case. The work is additional to that done by dairy companies who employ private testing officers either at a wage or at a definite rate per cow. When associations are large enough to afford sufficient employment for a testing officer to devote his full time to this work, or where a testing officer can test for two or more smaller associations, the work in the majority of cases is being carried on satisfactorily. Unfortunately, not all companies have sufficient cow-testing offering to keep a testing officer fully occupied; neither is it always convenient, because of the distance between dairying centres, to increase the number of associations under such officer's control. Doubtless, however, there are districts where proper organization would remove the difficulty.

Some of the dairy companies have asked the Dairy Division to appoint testing officers at the company's expense. In a few instances this was done, although later developments modified the financial arrangements and also the status of the officer, whereby he was asked to do some instruction work amongst the milk-suppliers as well as to take control of the cow-testing association. By providing less experienced assistance for some of the detail work connected with the testing the official is given an opportunity for more outside work. This method appears to be working very satisfactorily indeed. Moreover, it enables the dairy company to get most value from the official's time.

In other instances the organization of cow-testing associations has been accomplished by energetic and enthusiastic factory-managers. They, in various companies, have secured sufficient support for a moderate-sized association and undertaken the testing and figuring. Such work, however, usually takes up too much of a manager's time, so that in some instances it has been found difficult, and even impossible, to continue this praiseworthy enterprise.

The extension of the testing of purebred dairy cows by the Dairy Division has each year necessitated the appointment of additional testing officers. There are now some seventeen officers engaged in this work, and the increased demand for the testing has brought them into districts which previously were not regularly visited. This being so, the Division has had an opportunity of coming to the rescue of a number of cow-testing associations that would otherwise have become defunct. A number of these are included in the list of twenty-seven associations for which Dairy Division officers are this season testing and figuring returns. In addition to sustaining associations which could not have otherwise survived, new ground has been broken and the testing carried into other districts. Having received departmental approval for the extension of the testing work on this system—under which the dairy company guarantees the Department the testing-fee of two shillings per

cow and grants the free use of its testing room and appliances—many testing officers of the Division have evidenced a praiseworthy keenness in getting new associations under way.

The association testing of grade and crossbred cows as found in our dairy herds, and the C.O.R. testing of purebred dairy cows, are mutually complementary. The association testing awakens an interest in better breeding on the part of the dairyman, while the testing of purebreds indicates the producing-strains and affords information to the dairyman regarding the producing factors behind purebred bulls which may be available for purchase. In addition to this, the testing of purebreds assists breeders materially in formulating their breeding plans.

We hope to see the association testing become a stronger factor each year in the improvement of our dairy herds. This work is in direct line with an increase in the production of primary products which economists assure us is the key to relieving the present stringency. By producing more milk and butterfat we shall, after providing for the local population, have an increased surplus available for export. At present prices this increase will be more effective in bringing financial credit to New Zealand than would have been the case from an equal surplus in the past.

An example of summarized figures for the testing associations now operated by Dairy Division officers may be interesting to *Journal* readers. The results of the tests for the thirty-day period ending in December, 1919, were as follows:—

Associa. ion.	Association Average.			Highest Herd-average.			Lowest Herd-average.		
	Milk.	Test.	Fat.	Milk.	Test.	Fat.	Milk.	Test.	Fat.
	lb.	%	lb.	lb.	%	lb.	lb.	%	lb.
1	1,099	3·7	40·76	1,168	5·0	58·23	944	3·5	33·29
2	974	3·6	35·07	1,175	3·8	45·23	744	3·5	26·34
3	880	3·5	31·58	1,115	4·2	47·77	595	3·4	20·51
4	920	3·4	31·69	1,240	3·4	42·38	626	3·4	21·52
5	890	4·0	36·68	1,123	4·2	47·55	679	3·8	25·80
6	874	4·3	36·69	893	4·7	41·53	747	4·3	31·87
7	797	3·9	31·77	923	5·1	47·46	645	3·5	22·59
8	828	4·3	35·70	885	6·1	54·19	492	3·8	18·60
9	816	4·3	35·26	905	5·3	48·26	662	4·2	28·09
10	908	4·0	37·10	961	4·2	40·49	824	4·2	34·26
11	874	3·9	34·44	900	4·7	42·68	606	4·3	26·12
12	986	4·1	40·85	1,290	3·8	49·19	866	3·9	33·37
13	621	4·0	25·19	651	4·9	32·17	498	3·5	17·45
14	862	4·3	37·08	1,062	4·3	45·56	836	3·7	30·70
15	924	4·2	38·80	980	4·7	46·50	836	3·8	31·46
16	823	4·1	34·91	1,023	4·0	41·37	711	3·5	24·81
17	860	3·9	34·14	916	4·5	41·79	635	3·9	25·24
18	906	4·3	38·99	1,340	3·6	47·71	730	3·7	27·15
19	904	4·0	36·99	1,038	4·5	46·27	715	4·0	28·95
20	973	4·0	39·34	1,187	4·2	50·13	925	3·5	32·34
21	929	4·3	39·94	970	5·0	48·91	860	3·7	32·13
22	964	4·2	40·63	1,237	4·5	56·02	941	3·6	34·18
23	874	4·2	36·53	1,170	4·6	53·98	612	4·1	25·52
24	890	3·9	34·72	1,070	4·2	44·07	643	3·7	23·62
25	612	3·8	23·58	1,155	3·9	45·29	362	3·6	13·36
26	771	4·4	33·89	901	4·9	44·17	624	3·5	21·82
27	842	4·2	35·26	1,157	4·9	57·24	655	3·7	24·20

Average of all associations : 874 lb. milk, 4·1 test, 35·43 lb. fat.

CONTROL OF RED MITE ON APPLE-TREES.

TESTS AT PAPANUI EXPERIMENTAL ORCHARD.

G. STRATFORD, Orchard Instructor, Christchurch.

A SERIES of experiments for the control of red mite was initiated at the Papanui Experimental Orchard early this season, using various brands of red oil and lime-sulphur. The orchard is an old one, with trees ranging from twelve to twenty-five years, and suitable in every way for the experiments. The trees were excellent subjects to work on, being badly infected with red mite, and it could hardly be expected to entirely eliminate the pest in one season. On the whole the experiments have been very successful, and the mite has been reduced to a minimum. A power sprayer was used throughout, a constant pressure of from 200 lb. to 250 lb. being maintained. Careful observations were made before and after the sprayings, and the data collected afford much useful information to the fruitgrowers of the district.

OIL-SPRAYING.

The brands of red oil used for the tests were "Orchard," "Dial," "Gargoyle," and "Federation." All brands were applied at a strength of 1-8, on 20th August, 1919. The varieties sprayed were Sturmer, Ribston Pippin, Adams Pearmain, Jonathan, and Rokewood. The mite was very prevalent on all these trees when spraying was done. Live mite was first noticed on the unsprayed trees on 16th October. The following are notes of the operations and results with each brand of oil used:—

Orchard Brand: One row of eighteen Sturmers and one row of mixed apples. Mite very bad. Examined on 10th October and 20th November. Spraying had apparently destroyed the great majority of the eggs; very few hatched out. Examined again on 12th December, and finally on 12th January. Trees practically free from mite. This brand of oil does not show on trees so well as other brands, but appears effective.

Dial: One row of eighteen Sturmers and one row of mixed apples and plums. Mite very prevalent, especially on Sturmers. Spray did its work well, and appeared to have destroyed the majority of eggs when examined on 20th November. Trees examined again in December, and finally on 12th January. Results very good, practically no mite being visible.

Gargoyle: One row of Sturmer and Ribston Pippin. Mite bad. When examined on 20th November there appeared to be quite a number of mites not destroyed. Examined again in December and January. Results very satisfactory, but not quite so good as with other brands.

Federation: One row of Sturmer. Trees very bad with mite when spraying was done. Examined on 10th October and 12th December, and finally 12th January. Results very good, trees being practically

free from mite. This oil did not emulsify as readily as other oils, but showed up well on the trees and appeared to last for a long time.

LIME-SULPHUR SOLUTION.

Further experiments were carried out, using lime-sulphur at different strengths at different periods. The following notes indicate the practice followed and the results :—

(1.) One row of Lord Wolseley sprayed on 18th September at strength of 1-6, at bud-movement. Trees about the worst in the orchard for mite. Examined 10th October. Much evidence of mite on trees apparently not affected by spray. Sprayed again on 14th October, 1-25, at open cluster-bud. Slight burning of tips of foliage, but not sufficient to do any damage. Mite still noticeable. Sprayed again on 15th November, with 1-80, at formation of fruit. No injury to fruit or foliage. Examined 21st November. Practically no mite visible. Further examinations in December and January. Results excellent considering state of trees when first sprayed.

(2.) One row of Lord Wolseley sprayed on 18th September, 1-6, at bud-movement. Sprayed again 14th October, 1-25, at cluster-bud. Results from these trees were practically the same as No. 1. On 15th November trees were sprayed, 1-100, at formation of fruit, as against 1-80 in No. 1. This strength appeared to give as good results as 1-80, and the trees were practically free from mite when examined on 21st November. Further examinations in December and January confirmed this.

(3.) One row of Rokewood sprayed on 23rd September, 1-25, at cluster-bud, the bud-movement spraying being omitted. No dormant dressing was given. This spray burnt the tips of the foliage slightly, and when examined on 9th October the eggs of the mite appeared sound. Live mite was noticed on 16th October, and on 29th October mite was bad. Sprayed, 1-100, 8th November, mite being prevalent at time of spraying. Mite checked considerably, and trees appeared as good as others when examined on 21st November. Examined again in December and January, when trees were found practically clean.

(4.) One row of Sturmer sprayed 6th August, 1-6, at bud-movement, and again 1-25 on 10th October, at cluster-bud. The fruit-formation spray was omitted so that comparisons could be made with other trees. When examined on 21st November red mite was bad. These trees were left as long as possible in order to watch results, but as the mite was on the increase a spraying at 1-80 was given early in December. On examination in January live mite was found, although not bad.

CONCLUSIONS.

As previously stated, the trees experimented with were very bad with mite. Considering this, all the brands of red oil used were very successful in the destruction of the winter eggs, reducing them to a minimum, so that very few hatched out. There was very little distinction between the different brands used, and no damage was done by any of the oils. From these experiments it appears that a delayed spraying, using the oil at strength 1-8, as late as possible, will do much to control red mite when in the egg stage.

Where lime-sulphur was used the 1-6 and 1-25 sprays appeared to have very little effect on the eggs, which presented a healthy appearance some days afterwards—in fact, these sprays did not prevent the hatching of the eggs. The lime-sulphur sprays at 1-80 and 1-100, at fruit-formation period, were most successful, clearing up the newly hatched mite to a remarkable degree. This was very noticeable on the row of trees sprayed at 1-6 and 1-25 only, the fruit-formation spray of 1-80 being omitted. Spraying at 1-80 was delayed as long as possible on these trees, but on examination it was found necessary to apply it early in December. At the final examination in January mite was found on these trees, as well as many summer eggs. From the experiments it appears that lime-sulphur at strength 1-80 to 1-100, used at the fruit-formation period, when the mite is on the move, is a most valuable spray.

CO-OPERATIVE FRUIT-VARIETY TESTING.

TASMAN AND LOWER MOUTERE AREAS.

W. T. GOODWIN and W. C. HYDE, Orchard Instructors.

TASMAN AREA.

THE purpose for which co-operative fruit-testing plots were initiated was indicated in an interim report concerning the area established on Mr. A. McKee's property, at Tasman, Moutere Hills, Nelson, published in the *Journal* for May, 1917. The term of seven years for which this experiment was undertaken has now expired, and the full management of the area has been taken over by the owner. In publishing a summary of the results of the trials it must be clearly understood that the conclusions are based on a seven-years test.

Apples.

The varieties that have made good growth and are cropping well are as follows: American Golden Pippin, American Summer Pearmain, Ballarat, Buncombe, Cox's Orange Pippin, Crisp's Russet, Delicious, Duke of Clarence, Dunn's Favourite, Early Joe, Golden Pearmain, Gravenstein, Gravenstein Rouge, Jonathan, King David, Lady Carrington, Liveland Raspberry, Parlin's Beauty, Pomme de Neige, Reinette du Canada, Rhodes Orange, Ruby Gem, Rymer, Salome, Scarlet Pearmain, Senator, Shiawassee Beauty, Shorland Queen, Statesman, Stayman's Winesap, Sturmer, Wagner, White Winter Pearmain, Willie Sharp.

While all these varieties grow well in the locality, it is not to be assumed that they are all recommended for planting for commercial purposes. Many considerations have to be taken into account before undertaking extensive planting on commercial lines, such as the quality of the variety, its marketable value, and keeping and carrying qualities. Most of the well-known popular standard varieties do well in the locality, and in the test area there were no other varieties with outstanding merits that are likely to displace them.

The following varieties, which also did well on the plot (good growth of trees with very fair crops), proved to be of inferior quality, and for that reason cannot be recommended for planting in the locality: Ben Davis, Coldstream Guard, Dillington Beauty, Dumelow's Seedling, Edward Lippiatt, England's Glory, Gascoigne's Scarlet, Loy, Mona Hay, The Queen, Thomas Rivers, Welcome, William Anderson.

Calville Blanche D'Hiver, Surecrop, and Wright's Perfection did not do well on the plot and may be classed as poor doers for the locality.

The following, up to the present, have proved exceedingly light croppers: Allsopp's Beauty, Barry, Champion, Cliff's Seedling, Climax, Cornish Aromatic, D'Arcy's Spice, Lane's Prince Albert, Late Gravenstein, Marshall's Red, Wealthy, Winterstein.

Cleopatra, a well-known variety, does not do well in this locality, owing to its excessive susceptibility to powdery mildew and black-spot. Golden Reinette and King of Tompkins County failed to prove suitable owing to the attacks of woolly aphis, to which they were extremely susceptible. King Edward VII and Taupaki failed for a similar reason in regard to bitter-pit.

The following varieties were grown on the area with inconclusive results, and are recommended for further testing: Alfriston, London Pippin, Lord Wolseley, Yates, Esopus Spitzenberg, Foster, Newtown Pippin.

Pears.

The following varieties proved good croppers, and have done well in the locality: Beurre Bosc, Beurre Clairgeau, Beurre Capiaumont, Doyenne du Comice, Durondeau, Glou Morceau, Harrington's Victoria, Howell, Huyshe's Victoria, Keiffer, Koonce, Madame Cole, Madame Lang, Marie Louise, Triomphe de Vienne, Vicar of Winkfield, Wilder, Winter Bartlett.

Other varieties that cannot be recommended for planting on this class of land are: Bazi Mai, Josephine de Malines, and Jargonelle. The latter, although a vigorous tree and doing well, has no commercial value.

L'Inconnue, Flemish Beauty, and Le Lectier are recommended for further testing.

Stone-fruits.

Stone-fruits were also tested on the area, but owing to several causes the results are somewhat indifferent.

Apricots that promise fairly well are: Campbellfield Seedling, Heemskirk, Pineapple, Shipley, and Warwick. Heemskirk and Shipley made the best record both in the way of growth and bearing-capacity.

Varieties of plums that have done exceedingly well are: Denyer's Victoria, Evans's Early, Golden Gage, Green Gage, and Pond's Seedling.

Cherries that have done well are: Bedford, Prolific, Black Eagle, Black Tartarian, Centennial, Florence, May Duke, St. Marguerite, and Werder's Early Black. Of these Centennial and May Duke are outstanding.

LOWER MOUTERE AREA.

This area is in the orchard property of Mr. C. H. Mackay, and the seven-years term of the test has also expired. An interim report was published in the *Journal* for September, 1917.

The test has demonstrated that practically all varieties worth growing will do well in this locality. The test was mostly confined to varieties that are not generally grown in the district. Those varieties which have proved their adaptability to the locality, including such standard varieties as Sturmer, Jonathan, and Dunn's Favourite, were grown in neighbouring orchards, and were not included in the area under trial.

Apples.

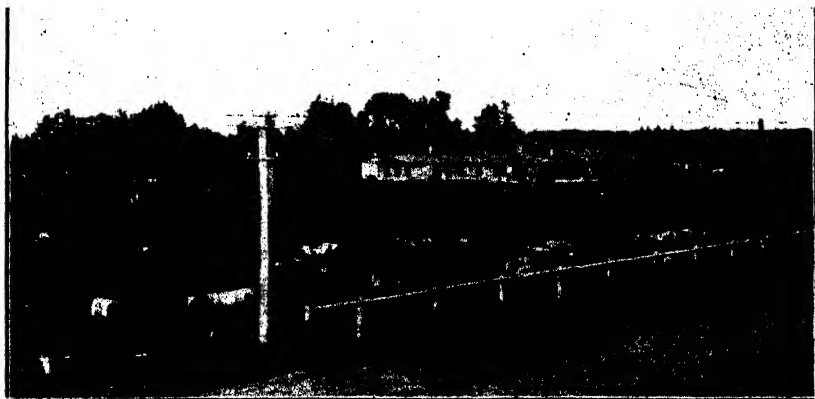
The undernoted varieties did particularly well, both in growing and bearing capabilities: Alfriston, Beauty of Bath, Ballarat, Claygate Pearmain, Delicious, Dillington Beauty, Dougherty, Duke of Clarence, Granny Smith, Gravenstein, Ribston Pippin, Scarlet Pearmain, Senator, Stark, Worcester Pearmain, Yates.

The remarks made regarding the varieties tested at Tasman also apply to the foregoing list when the matter of considering extensive planting is under consideration. The main object of the experiment was to ascertain the adaptability of the varieties to the district.

The following varieties proved unsuitable, chiefly for the reasons stated: Baldwin—vigorous growth, but too light in bearing-quality; Dumelow—good doer, but fruit of very poor quality; French Crab—very susceptible to powdery mildew and woolly aphis; Loy—poor doer and light bearer, fruit of very inferior quality; Welcome—tree a good doer, fruit very small and grows in clusters, no commercial possibilities; William Anderson—good doer, but fruit of inferior quality.

Pears.

The following well-known commercial varieties of pears did very well and maintained their reputation: Beurre de Capiaumont, Conference, Doyenne du Comice, Fertility, Marie Louise, Louise Bonne de Jersey, Winter Cole.



RETURNED SOLDIERS' QUARTERS AND SOME OF THE MILKING SHORTHORN HERD
AT RUAKURA FARM OF INSTRUCTION.

WORK FOR THE COMING MONTH.

THE ORCHARD.

THE OUTBREAK OF FIRE-BLIGHT.

ATTENTION was recently called to an attack of a new disease in the Tauranga, Waikato, and Auckland districts attacking apple, pear, and quince trees, and hawthorn hedges. It has now been identified by the Biology Section as the disease commonly known in America as fire-blight, and caused by the organism *Bacillus amylovorus* Burrill.

The disease has been definitely identified on all the foregoing plants. It is also suspected to exist on one or two other kinds, which are now the subject of investigation. As soon as this is completed it is proposed to publish a full account of the disease. In the meantime the following brief particulars will be sufficient to acquaint growers with the nature and seriousness of the disease.

In America fire-blight is responsible for an enormous amount of damage to pome-fruit trees, consequently its appearance in the Dominion has been dreaded by those interested in the fruit industry. It attacks and kills the blossoms and young shoots, and is readily recognized by the leaves withering and drying and remaining attached to the diseased parts. At the base of infected spurs and twigs cankers form, which rapidly spread, and frequently ring-bark the limb, thereby causing death. Where infection is severe the tree is killed outright.

As this is a bacterial disease, the only known remedy is to cut away and immediately burn all diseased parts. Cut diseased shoots and smaller branches about 1 ft. below the lowest point of visible infection. By cutting out the canker well outside the margin of infection large branches can often be saved. When this is done the wound should be immediately disinfected by swabbing with a 5-per-cent. solution of formalin, lysol, or some other germicide. After sterilizing, the wound should be painted over with coal-tar. All tools used should be sterilized in one of the foregoing disinfectants after each cut.

The Department realizes the seriousness of the outbreak, and, with a view to definitely determining the limits of infection, as many Orchard Instructors as possible have been assembled in the affected areas. At the same time the earnest co-operation and assistance of every owner of fruit-trees is solicited. Every grower who has trees showing conditions resembling the foregoing description is asked to notify the Director of the Horticulture Division, Wellington, or the Orchard Instructor for the district. At the same time he is urged not to await official identification of the disease, but to remove and destroy all dead wood. Specimens carefully and securely wrapped should be forwarded for identification to the local Orchard Instructor, who will further attend to the packing. This is advised with a view to eliminating all possibility

of further spreading the disease by means of indifferently packed specimens. For the same reason growers should entirely refrain from posting specimens to any one at all, other than the departmental officers referred to, even though requests to do so are based on the plea of education, &c. The Department will attend to this phase of the question, and will keep growers well informed from time to time.

—J. A. Campbell, *Assistant Director of the Horticulture Division.*

AUCKLAND.

There appears to be an increasing inclination among growers to suspend their applications of arsenate of lead at too early a date. Codlin-moth is usually still active well into April, and it is therefore advisable to continue moth-sprays right up to the end of harvesting. As woolly-aphis attack is invariably heavy in the autumn, nicotine sulphate, 1-800, should be used throughout in conjunction with the lead.

The stone-fruit season concluded, growers would do well to pick up and destroy all mummified fruits from the orchard, in order to minimize the source of infection of brown-rot for next season.

In cases where citrus trees have not been sprayed for the control of sucking-insects, such as scales, thrips, &c., red-oil emulsion should be applied at 1 to 40, care being taken to see that young growth is well hardened off.

By the beginning of April the main autumn crop of lemons will be set, and it is then time (as the blossom-petals fall) to spray thoroughly with bordeaux, 4-4-40, or lime-sulphur, 1-35. If it can be so arranged, oil should follow the fungicide, but an interval of four to five days should elapse between the two applications.

Pip-fruits which it is intended to store will mostly be gathered in April, and in this regard much care in picking and handling is necessary.

Orchardists who are intending to extend their plantings will find April the best month to get the plough in and commence the final operations for preparation for planting.

—J. W. Collard, *Orchard Instructor, Auckland.*

HAWKE'S BAY.

At this period of the season sprayings for codlin-moth are usually discontinued, but it will be wise to spray at the usual strength varieties which have some time to hang on the trees, not only as a moth-control but to minimize the loss due to leaf-roller caterpillar, which continues very active until quite late in the season.

As there is a great possibility of a late infection of black-spot on such susceptible varieties as Dougherty and Rome Beauty, a sharp lookout should be kept, and bordeaux, 3-4-50, applied on the first appearance of activity. Red mite has been very active over a prolonged period this season, no doubt due to the favourableness of the dry weather. Control measures will depend on the condition of the trees. Those carrying fruit, and susceptible to scorch, should be sprayed with Blackleaf 40, 1-800, and hardy varieties carrying fruit with the less expensive lime-sulphur, 1-100, while trees from which the fruit has been harvested may be sprayed with oil, 1-80. Further sprayings of Blackleaf 40 will be necessary to check as far as possible the autumn brood of woolly aphis.

March to April usually finds the orchards more or less run to weeds, cultivation having been suspended during picking-time. Where a weedy condition exists it will be a distinct advantage, both as a convenience and to prevent seeding, to use the mower, and let the weeds lie as cut, if the condition of the trees will allow this to be done.

In regard to extensions and new plantings, early ploughing should be done wherever possible so as to ensure full advantage of the autumn rains and permit the land to be worked well in advance of planting. Experienced growers will no doubt remember the shortness of supplies of certain varieties of fruit-trees last season and make provision for contemplated plantings by placing the order early with the nurseryman.

—W. M. Rice, *Orchard Instructor, Hastings.*

NELSON.

The harvesting of late varieties of apples and pears is among the most important work in the orchard at this season. Grade out the poorer qualities

for immediate disposal, and store only clean, sound fruit; good stocks are too often contaminated by neglecting this precaution. Fruit to be stored in an orchard-shed for some time should be stacked with the same care as in a cool store—that is to say, the stack should be some 4 in. from the walls, and each pile of boxes 1 in. or so from the next. Such an arrangement allows for satisfactory ventilation. Where large stocks are to be held it is advisable to place them well up on a false floor, to allow an indraught of cold air to be admitted when necessary.

The orchard will require to have fungus-infected fruit well cleared up. The fungus does not die because it is on the ground; it is in exactly the right place to grow and flourish, and become a menace to the trees next season. Any autumn spraying required should be done without delay (see last month's notes). Stone-fruit trees which have been badly affected with brown-rot or other fungus should be given one or two good applications of bordeaux at summer strength.

In most orchards a cover-crop is required. It is now rather late to sow lupins, but horse-beans, vetches, and oats may be sown.

—W. C. Hyde, Orchard Instructor, Nelson.

MOTUEKA.

The principal work for the month will be harvesting and storing the main crops of the later varieties of apples. Fruit for storing should be carefully selected and graded; inferior fruit will not pay for storage charges. Care should be taken that badly bruised fruit or fruit with skin broken—either by rough usage or deep cracks—is not included among that intended for late keeping. Where properly constructed cool stores are not available, and the fruit is stored under ordinary conditions, see that the ventilation is good, especially at the top of the building, to allow foul air from the fruit to escape.

Grading and packing out to standards should be undertaken by every fruit-grower. Where grading-machines are not in use the sizing of the fruit by hand methods should be done by a competent set of sorters in the orchard. It will generally be found that two pickers can keep two sorters going. This orchard sizing is better carried out by having a portable table or bench with extended handles for transporting about the orchards. The bench can be made large enough to hold about half a dozen cases, this serving to accommodate the various sizes of any particular variety and allow a case for the obvious culls, which should be rejected at the first handling. Each table will accommodate two sorters, one on either side, working into the same cases. Where picking-bags are used one end of the table may be converted into a bin by suspending sacking, into which the pickers empty their bags of fruit for the sorters to operate upon. Colour and quality grading may subsequently be carried out in the shed according to standards. I would strongly recommend that this grading be done before the fruit is stored. By doing this the fruit is well sorted, and those grades may be selected for packing out which will not keep as long as others, thus doing away with a lot of picking-over when taking out of storage.

—W. T. Goodwin, Orchard Instructor, Motueka.

CANTERBURY.

The orchardist's chief occupation at the end of March and during April will be the picking, grading, packing, and marketing of his apples and pears. Growers should realize that this is one of the most important branches of the industry, and work accordingly. Take care when picking the fruit not to damage any fruit-spurs, and only pick well-coloured and matured fruit, leaving the balance for a further picking. Grade and pack carefully, and place the fruit on the market in the best condition possible. If cool storing, lose no time between the picking and the placing in the cool store, and only send in sound fruit. Bruised fruit will not store properly, and fruit with the skin broken or damaged in any way often causes decay in sound fruit. It is not worth paying storage charges on unsound fruit only to find at the end of the season that the fruit is much worse than when put in. The matter rests largely with the orchardist. Fruit from young trees is much better marketed as soon as picked, as it does not store well.

Those orchardists intending to put in green crops for turning under in the spring should attend to it early this month. The orchard should be well ploughed and harrowed down, making a good seed-bed. If artificial manure is to be applied it will be as well to drill it in with the seed.

—G. Stratford, Orchard Instructor, Christchurch.

OTAGO.

At this time of the year woolly aphis usually becomes very prevalent, and laterals and buds for next year's fruiting are often destroyed. Many growers make the mistake of waiting till the spring to fight this pest, by which time the damage is done. The better plan is to destroy the pest before it destroys the laterals. Cut away inside growths and surplus shoots, and spray well with Blackleaf 40, at 1-800. Good results can also be obtained by the use of red spraying-oil, 1-60, but it is not advisable to use this spray till the apples have been removed from the trees. The addition of a small quantity of Blackleaf, equal to 1-2,000, enhances the value of the oil spray.

Where leaf-roller caterpillar is prevalent a further application of arsenate of lead should be made, especially on apples which are to be stored, otherwise the grubs will hatch out on the fruit in the cases after storing.

Growers are again reminded to keep a lookout for late infection of black-spot after rainy and misty periods, and to spray with lime-sulphur, 1-120, where necessary.

J. H. Thorp, Orchard Instructor, Dunedin.

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

CULLING AND SELECTION OF THE BREEDING-HENS.

THE culling of the hens that have passed their best period of production, and the selection of the most desirable specimens for next season's breeding-pens, are matters which should claim the first attention of the poultry-keeper at the present time. Indeed, if this important work be delayed now it is impossible for it to be carried out to the best advantage at a later date, chiefly for the reason that if left till the flock has fully moulted choosing between the good and bad layer is a matter of great difficulty.

All things being equal as to the time of hatching, and when the flock has received uniform treatment in regard to feeding and general management, it will usually be found a safe course to discard the birds that moult first and retain in the flock the late moulters for breeding and laying purposes. In this connection it is not to be inferred that all late moulters which give indications of being heavy layers are desirable breeding specimens, for the best layer is not necessarily the best breeding-bird. Breed and laying-type, the desired size, together with points indicative of constitutional vigour, must be combined if desirable progeny is to be produced. For instance, a freak type of bird may prove to be a late moult and a heavy layer, but, if bred from, its progeny in all probability would prove disappointing.

The point cannot be emphasized too strongly that to maintain a flock of heavy egg-producers the breeder must have an ideal type in his mind's eye, and choose birds as near to this as it is possible to do. Breeding from hens of various types and sizes merely because they have a good egg-performance behind them is no doubt responsible to a considerable extent for much of the weak stock being bred at the present time. I have recently seen breeders who were pinning their faith on small weedy hens as future breeding specimens for the sole reason that they possessed a fair single-pen egg-record, whereas birds were to be

seen among the general flock and of the same strain that were of ten times the value from a breeding viewpoint. This is not said in any way as a condemnation of single pens, but rather to emphasize the importance of placing in the testing-pens in the first instance only pullets of uniform type and desired size, and which are at any rate likely to produce desirable progeny when bred from.

It is, however, not always feasible or convenient for every poultry-keeper to use single pens as a means of determining which are his best layers. He must therefore depend on picking out according to laying-type and points indicating constitutional vigour, and in this connection the time of moulting gives the best guide to a bird's productive capacity. For a bird to produce a high yearly egg-record, whether confined in a single pen or running with a flock, she must necessarily be a long-season layer and obviously a late moulter, for it would be an exception to the general rule for a bird to complete its moulting process and continue laying at the same time. In addition to being a late moulter the good layer at this season of the year will usually have weatherworn shabby-looking plumage, red healthy-looking comb and face (the latter being free from feathers), bright prominent eyes, well-bleached shanks (in the yellow-legged breeds), fullness of abdomen, and wide pelvic bones. She will also be a heavy feeder and still retain an active businesslike appearance. The poor layer, apart from being an early moulter, is usually very fat, has well-kept plumage, bright yellow legs, feathered face, overhanging eyebrows, spare abdomen, contracted pelvic bones, and generally an inactive appearance.

The selection of the late moulters for future breeding is not the only essential. Something more is required. They should be marked as breeders, and then, by lighter diet or a change of diet, or a change of quarters, be discouraged from laying and encouraged to moult. Changing the ration from wet mash to whole grain for a week, and then suddenly changing back to the mash, will usually have the desired effect. This will give the birds an opportunity to recuperate and build up their bodily vigour before being called upon to lay eggs for hatching purposes. This advice is based on hard experience. I have bred from high-scoring competition and forced birds, only to find that the progeny were weakened specimens, unprofitable as producers, and most undesirable as breeders.

TUBERCULOSIS.

This is the time of year to keep a watchful eye for birds showing signs of being affected with tuberculosis. One- and two-year-old hens that are finishing up an exhausting laying season and are not in a vigorous condition are most liable to become affected with this disease should they come in contact with the tuberculosis germ. The latter usually attacks the liver and spleen, which later become covered with tubercular nodules. These vary in size, sometimes being as small as a pin-head and in other cases as large as a pea. They can easily be seen on post-mortem examination and when the disease has reached a fair stage of development. As a rule the first outward symptom is a rapid wasting of flesh, particularly surrounding the breast-bone, the latter standing out as a sharp ridge. Later, the wings and tail droop, the plumage becomes ruffled, there is usually lameness in the right leg, and the bird will frequently be seen standing on one leg with its

head under its wing. At this stage the bird shows little desire for food, even when of a most appetizing nature. Later the evacuations become a greenish-white, and often adhere to the fluff feathers surrounding the abdomen. From this onward the bird appears to be in a dazed, listless condition. It gradually becomes more emaciated, and finally dies.

Tuberculosis is probably the most dreaded disease that the poultryman has to fear. Most other troubles which affect poultry can be easily checked if taken in time, but it is entirely different with this disease, and once it makes its appearance in a plant there is no telling when it is going to be effectively stamped out. The excreta of a diseased bird contain large numbers of the tuberculosis germ, and it will be easily understood that the food, &c., may get contaminated, and a healthy bird become affected. It is useless trying to doctor a bird affected with tuberculosis. All that show the slightest signs of being affected should be killed and burnt at once. Prevention is the one and only safe course. The first essential in this connection is to breed birds with the necessary constitutional vigour to resist the infection. Further, too much emphasis cannot be placed upon the value of cleanliness, good feeding, and well-ventilated houses. Above all, never allow the runs to get into what may be termed a "poultry-sick" condition.

THE APIARY.

G. V. WESTBROOKE, Apiary Instructor.

ROBBING.

By this time most of the season's honey will have been removed from the hives and extracted. Some beekeepers prefer to leave the honey in the hives until late autumn, but, while it is claimed by some that this method conserves the flavour and ensures ripeness, it is not usually adopted. The disadvantages of late extracting probably outweigh the advantages. Perhaps the greatest drawback is the liability to set up robbing when removing the honey so late in the season, and this is an important matter to consider.

Robbing, as understood by beekeepers, is the act by which bees steal from each other or from any source where sweet substances are left exposed. The cause of robbing is usually the sudden stoppage of the flow of nectar in the fields. Bees will not attempt to rob while a good yield of nectar is obtainable. In fact, at such times combs of honey may be exposed in the apiary without being molested by the bees. But as soon as the blossoms cease to yield, the leaving of even small portions of honey near the apiary would cause a commotion, and would in most cases start the bees robbing out any weak colonies. At such time the bees become very cross and seem to delight in looking for trouble. At the fall of the year the beekeeper should therefore take every precaution and refrain from dropping any pieces of honeycomb about. He should also open the hives as little as possible, any manipulations required being done late in the afternoon.

Robbing is easily detected when in full swing, but is very hard to stop. The first symptom noticeable is usually the uproar of excitement

around the particular hive being robbed, and this, when examined at the entrance, will be found to be a scene of turmoil. In such a case the hive should at once be closed down to one bee-way entrance, and if the trouble continues it may be found necessary to close it up altogether until dark.

Slight cases of robbing, however, are not so easily detected, and beginners are sometimes unnecessarily alarmed by the action of the young bees on a fine afternoon when flying about the entrance of the hive taking their bearings. If robbing is suspected the best way is to carefully watch the entrance to the hive. A bee leaving the hive for the fields comes out casually and leisurely, quietly taking flight from the alighting-board. A robber-bee when leaving the hive with its load of stolen sweets invariably hurries out, usually climbs up the front of the hive before taking flight, and then takes a downward curve until it has controlled its balance. Another suspicious sign is small particles of wax capping scattered around the entrance.

The best plan is to take precautions so that there is no excuse for its starting. See that all extra ventilation is closed as soon as the flow is over, giving the bees only a small entrance to their hive. Take care that no bees can gain access to the honey-house or any sweet substance such as honey, jam, or syrup. Do not open the hives more than is necessary, and then only for a short time. See that all covers of hives are secure, so that they cannot be blown or knocked off. Unite any weak or queenless colonies.

UNITING WEAK COLONIES.

Now that brood-rearing will be lessening it is advisable to unite any weak colonies. Perhaps the best method is to kill the queen of the weak colony; then in the evening take off the cover and mat of a fairly strong colony, and place a double sheet of newspaper over the top; next quietly lift the weak colony off its bottom-board and place it over the strong colony. This will result in the bees being confined until they have eaten their way through the paper, which will take a couple of days, and by that time they will unite without fighting. The hive should not be again disturbed for a few days. If the weak hive contains a good young queen which has not had time to build up, it can be united to a queenless colony by the same method.

VITICULTURE.

S. F. ANDERSON, Vine and Wine Instructor.

WINEMAKING OPERATIONS.

LAST months' notes dealt principally with the time of gathering and the condition the winemaking grapes should be in when commencing the vintage. It will be assumed that everything is now in readiness in the press-house and cellar for getting in the grapes. The making of dry red wine will first be dealt with, as in New Zealand it covers the principal work, the making of sweet wine being usually an after-manipulation by the addition of spirits and sugar to the dry wine.

Fermenting.

Where the grapes have been gathered at their maximum condition and all objectionable or green bunches thrown out, so that the resulting must comes up to the sample obtained from the tests made beforehand and obtained from an average of the crop selected for that purpose, it can be estimated what the probable alcoholic content of such a wine will be. Under usual conditions fermentation lasts from forty-eight to seventy-two hours. During this period, and where the grapes are fermented on their skins, the vigneron must give it close attention. The labour employed must be so divided that a reliable man is always on duty. As long as violent fermentation is proceeding the carbonic gas given off is a protection from the surrounding air and its contaminations. The fermentation brings to the top a thick layer of skins varying from 4 in. to 8 in. From time to time this has to be broken up and pushed down into the body of the vat. This is necessary to allow all the colouring-matter in the skins to be extracted by the process of fermentation. It is also a help in keeping the temperature down.

The temperature of the fermenting mass in the vats is an important matter, and should be under control. It may vary during the day from 75° to 95° F., and between these two points (say, 85° is as high as it should go. The fermentation is prolonged by the lower and hastened by a higher temperature. If maintained as near as possible to the mean of these points the wine will be the better for it. The weather during March and the early part of April is rarely too cold to seriously check fermentation. To prevent it going too high has generally been the concern of the New Zealand winemaker. One of the effects on the wine of allowing it to work at too high a temperature is the danger of its being affected by acetic, lactic, or other harmful bacteria; while at the lower temperature vinous fermentation soon sets in and holds its own, destroying the others. To maintain a right temperature, after breaking up and pushing down the cap of skins plunge the thermometer well into the body of the vat, note its reading, and if exceeding 85° draw off some of the must and pump it over the top, repeating this till the reading shows it is within the best limits.

It should be impressed on the mind of the winemaker that the grapes, fermenting-house, and all utensils teem with harmful bacteria. These can only be prevented from affecting the wine by keeping down the temperature of the vat-contents, and by the greatest cleanliness in conducting the work. The floor of the fermenting-house, the grape-boxes, and utensils should all be washed at least once in twenty-four hours. The warmer the weather the greater is the danger. It is within the period of the grapes being put into the vat, fermentation taking place, and its removal to the cellar that the wine is made good or bad.

As soon as filled the vats should be kept covered. Strong unbleached calico is the best for this purpose. The cover is removed from time to time to permit of the cap being pushed down and taking the temperature. The fermentation gradually slows down as the sugar is transformed into alcohol and carbonic gas, and the contents become cool. When completed, what was the must is now wine, and if tested with the saccharometer that instrument will float at zero.

or water-level. This indicates that all the sugar has been transformed. When quite still and the wine cool it should be drawn off, provision having been made beforehand by a perforated shield or bunch of twigs placed over the outlet and fixed inside the vat to keep back the skins. The wine falls into a tub placed for that purpose, and is pumped direct from that into casks. The shorter the delay in carrying out this work and the contact of the wine with the air the better for the wine. It is unavoidable in doing this that some of the thick portion goes into the casks, apart from a turbid state of the wine at this period. Before this matter finally settles in the wine a second or silent fermentation occurs, caused probably by some unfermented portion asserting itself. To provide for the escape of the carbonic gas from this secondary fermentation place small bags of well-washed coarse sand, about 6 in. square, over the bung-holes. This permits the escape of the gas while preventing contact with the air. Some winemakers keep the wine in the vats on the skins for some days, with the object of obtaining a deeper colour. If the weather is very cool and the vat closely covered possibly no harm will result. The practice is not recommended, however. If the grapes passing through their fermentation receive regular breaking-up of the cap all the colouring-matter will be extracted by the violent ebullition they pass through.

Making White Wine.

It will be noted on reference to last month's notes that, with the exception of Pineau Gris, the white-wine grapes do not attain the natural sugar-content of the dark ones. Wine from the white grapes is more delicate and subject to outside influences. It is not generally fermented on the skins. The white grapes are the latest in ripening and can be left to the last. The must from these grapes should not go into the ordinary wooden vats or casks in which red grapes have been fermented, as more or less colour might be imparted. There would not be any objection in the case of concrete vats, provided they were well cleaned.

The white grapes pass through the stemmer and crusher, the must coming out on to the floor of the press and running from that into a tub. From that it is pumped into a large vat to be aerated. As the stems and skins soon collect in the press and pile up, pressure can be applied two or three times till the press will not hold any more, after which the final pressure is completed.

Aerating the must of the white grapes is an important stage in the making of a white wine, on account of the albuminous matter in the white grapes, which is a hindrance to its keeping-qualities and fine flavour. To successfully carry out this part of white-wine-making sufficient grapes should be gathered the evening before, so that an early start can be made to fill a vat the following day, regulating the work so that the vat will be three-quarters filled early in the day. Aeration of the must for the purpose of eliminating the harmful albuminoids is done by four or five hours thorough stirring. Drawing the must off into a tub, and pumping it back into the vat, and letting it fall from a height of 3 ft. or 4 ft. is the best way of doing this. If scum collects it should be skimmed off and put into a vessel by itself, to be made use of afterwards. At the completion of the aeration pump the must

into the casks to ferment, not quite filling them, so as to allow of some working over, and cover the bung-holes with the small sand-bags already mentioned. Each day's work should be complete in itself—stemming, crushing, filling of vat, aeration, and finally pumping into the casks to ferment.

As the fermentation gets strong the froth works over more or less, and vessels should be put to catch it. The sides of the casks should be wiped clean with a damp cloth several times during the day. This froth rapidly becomes sour, and would communicate with the wine if neglected, setting up acetic contamination.

Further notes on the treatment of the wines will be given next month.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

IN the colder parts of the Dominion arrangements for the winter supply of vegetables will be completed by this time. In other places there is still time to put in a good breadth of turnips, though no time should be lost. In warm localities it is possible to get turnips from seed sown early in May, but the roots stand for such a short time that it is worth while only in exceptional cases of shortage. In warm places spinach may still be sown. Lettuces may be planted in all parts.

Cabbage-moth: It is possible to save small lots of affected cabbages if sufficient attention is paid to them, but the saving of large areas depends mainly on getting growing-weather. The worst infestations occur during very dry summers. Under such conditions it is practically impossible to save the crops, except where the soil naturally holds a good deal of moisture. When the season is cold and wet the moth is not troublesome. Between the two extremes there is the medium season, when the plants may grow fairly well, and yet there may be a fairly heavy infestation. Under such circumstances the crops can be saved. Spraying large areas in an effective manner is a practical impossibility. In addition to the habit the larvæ have of descending to the ground when disturbed and returning to the plant when danger is past, their work is mostly done on the under-side of the leaves, where it is difficult to reach them. I have found it best to concentrate attention on the saving of the young leaves forming in the centre of the plants. If these are injured by the insects growth must cease. A little hellebore powder dusted into the centres of the plants will save them from injury, and if some nitrate of soda is given to the roots there is every likelihood of the plants doing well. Cultivation between the plants should be frequent, and if the implement used brushes against the outer leaves it will cause many of the larvæ to drop to the ground, and a proportion of them is sure to be buried in the soil.

Brussels sprouts: About this time the plants are almost always attacked by a grey aphid, which, unless it is checked, speedily ruins

the plants. Spraying with Vistolene or XL All fluid will kill the insects and be the easiest method of control. Forcible syringing with boiling water is quite effective. The usable parts of these plants are the little rosettes that form in the axils of the leaves. The question is sometimes asked whether the leaves should be cut off to encourage the growth of the rosettes or sprouts. The answer is emphatically No. The sprouts will not develop properly without the leaves, which should not be cut off until they turn yellow. Seedsmen's catalogues show the plant without leaves, the leaves being removed to show the sprouts.

Onions: Most crops are harvested before now, but there are sure to be some backward crops. Rain following a dry spell may make available fertilizers that were inert for want of sufficient moisture, and this may lead to late growth and consequent delay in ripening-off. An overplus of fertilizer may have this effect without interference by the weather. If the bulbs are properly grown the necks should become thin and lose substance, and the tops fall over from their own weight. If this does not occur the bulbs have not finished properly, and they will not be good keepers. The cause may be too much manure, untimely rain, or an unsuitable variety; or, lastly, they may have been lifted too early. Giant varieties should be sown in autumn; if sown in spring they will not finish properly. Ripening occurs earlier in some places than in others, but in cases where the tops have not withered lifting should be left till March in order to give the bulbs a chance to finish ripening.

Turnips: Where the winter supply is of consequence it is a good plan to sow two varieties at this time—Snowball or a similar white variety for first use, and Golden Ball or Orange Jelly for later. The yellow varieties stand better through winter than the whites, and are at that season better in flavour. The yellow variety should be well thinned, as they are to stand. Thinning the white variety is mostly done when roots are pulled for use or market. This enables the taking of a large crop from the ground, and is the usual method of market-gardeners.

Celery: Late crops should be moulded up; they are better so than exposed to winter weather. The moulding-up protects them from heavy rain, the heads keep better, and are gaining crispness. Celery leaf-spot is causing losses as usual. Losses would be smaller if growers realized the early beginning of the disease. A very frequent cause is infected seed. When this is the case the disease attacks the seedling plants, but at this stage it may not be noticed unless it is looked for. Later on, when the disease has obtained a firm hold, it may be impossible to save the plants; certainly, badly affected leaves cannot be saved. Spraying with bordeaux mixture should begin with the seedlings and be continued as long as may be necessary. Growers are known to obtain complete control by this means. Some authorities state that the spores of the disease present on seeds die within two years, and advise that seeds less than two years old should not be used. The seeds retain vitality for eight years. The fungus may be killed by steeping the seed for a period of three hours in a dilute solution of 1 part formalin to 600 parts of water. The seeds should afterwards be quickly dried on sheets of blotting-paper.

Autumn sowing of cauliflower, cabbage, onion, and lettuce: These seeds should be sown during the last week of March or early in April. This sowing is one of the most important operations of the whole year, particularly so in reference to cauliflower, cabbage, and lettuce, because it provides for the spring crops, the most valuable of all both to the market-gardener and the private grower. Two kinds of cauliflower should be sown—Early Snowball or Early Paris for first cutting, and one of the Autumn Giant types for succession. In the warmer parts of the Dominion another lot may be sown about 1st May, and the combined sowings will carry the supply till the New Year. Heads from the first sowing should be ready during September, a month earlier than in other parts, rendering the growing of broccoli almost unnecessary. This is a great advantage, as broccoli has to be planted in summer, when the moth may make it impossible to grow it.

With onions autumn sowing applies most properly to the giant kinds. These cannot be brought to maturity if sown in spring. The young plants must be transplanted in spring; $1\frac{1}{2}$ lb. of seed will provide plants for an acre. In some circumstances it is advisable to sow the smaller keeping kinds in autumn. In some districts mildew attacks the plants early in the year, and this prevents the bulbs maturing in a proper manner. By sowing in autumn the plants are so far advanced in growth when the disease attacks them that they suffer little or no injury. It is not absolutely necessary to transplant these kinds in spring—in fact, many growers do not. There is, however, greater risk of the plants bolting to seed when not transplanted, and in some cases the ground becomes so weedy during the winter months that transplanting to clean ground becomes imperative. The small kinds being planted closer than the large varieties, 2 lb. of seed should be sown to plant an acre. If not transplanted, 3 lb. will sow an acre.

SMALL FRUITS.

Cape Gooseberries.—For practical purposes these plants have a life of two years. Seeds should be sown in boxes early in April, pricked off in other boxes when large enough to handle, and kept till spring frosts are past. Planting should be in an open position, so that the plants may make sturdy, fruitful growth. Personally, I prefer to plant in clumps of three plants. The growths then intermingle and the plants are firmly anchored, and wind will not disturb them. The clumps should be 5 ft. apart every way. The crop obtained during the second season is the heaviest. Commercial growers should have two plantations, setting out a new one each year, so that after the first year there would be always one lot giving the second crop.

Strawberries.—In some districts autumn planting is necessary, April being the best month. Care should be taken to firm the soil thoroughly round the roots. Where the character of the soil admits it is a good plan to pass a roller over the whole area after planting is done. This makes the soil firm and does not injure the plants. When the land is to be replanted with strawberries it is doubtful policy to plough in the old plants. The rootstock is woody, and even the foliage is hard. Neither decays for a long time, and the soil could not become properly consolidated; also there is the risk of leaf-spot contaminating the new plants. It would be wiser to cut the plants off with an adze and burn them.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

RINGWORM IN YOUNG CATTLE.

O. J. M., Paparata :—

What is the best treatment for some young cattle which are getting ringworm about the face and neck ?

The Live-stock Division :—

The affected parts should first be well washed with soft-soap and water. When dry a preparation of creosote, 1 oz., and olive-oil, 7 oz., should be applied with a stiff brush. Tincture of iodine will also answer the purpose. Whatever treatment is used the dressing should be extended beyond the affected parts. A second application may be necessary.

BEST STAND-UP WHEATS.

" INQUIRER," Frankton, Central Otago :—

We intend sowing about 100 acres of wheat this season. The soil is naturally very rich and has not been cropped for ten years, so we are afraid the crop will go down badly. We should be glad of advice regarding the best standing varieties.

The Fields Instruction Branch :—

Probably the variety which stands up best is Purple-straw Tuscan. Other varieties of Tuscan, such as White-straw and Solid-straw, also Hunter's wheat, are commonly grown on heavy land in Canterbury, where resistance to lodging is of considerable importance. Further, College Hunters can be counted on to stand drought conditions well, in addition to standing up well on heavy land.

EXPLOSIVES FOR HARD-PAN IN ORCHARD.

" POMUS," Waipukurau :—

The growth of a large number of trees in my orchard has been very much checked by the existence of a hard-pan of sandstone which runs through part of the orchard at a depth of from 1 ft. to 3 ft. below the surface. These trees are only about 5 ft. high in some instances, although they have been planted seven years. Would you kindly inform me of the best method of breaking the pan with explosives so as not to injure the roots of the trees, the best explosives to use, and the proper season to do it ?

The Horticulture Division :—

Some injury to the roots of the trees is sure to occur if sufficient explosive is used to do any real good. It would, however, do the trees no harm provided the work was done in autumn—April would be a good month. Holes should be made midway between the trees in each direction, and one in the centre of each square enclosed by four trees. The holes should go through the hard-pan if possible, or at least well into it. A $1\frac{1}{2}$ in. auger is the best implement where it can be used, the shaft being lengthened for the purpose. If an auger cannot be used a light steel crow-bar is the next-best implement for making the holes. A plug of gelignite is required for each hole, or possibly two plugs ; detonating-caps and fuse are also necessary. A cap is firmly fixed to one end of the fuse ; a cut is

made in the plug of gelignite, and the cap partly enclosed in it. The cap and fuse must be firmly tied to the explosive, which is then dropped to the bottom of the hole. The pieces of fuse should be long enough to allow a few inches to project above ground. Put dry soil into the hole and tamp with a wooden rammer. Tamp the first 6 in. lightly, the rest of the hole as hard as possible. Light the fuse and stand clear.

BOILS ON HORSES' BACKS.

"UTUKAI," Mangonui :—

Can you recommend a cure for boils on the backs of horses? My riding-horses have been subject to them since spring, and two months' spell has not improved their condition. The horses are on good feed and in good condition, and although methylated spirits seems to absorb the boils, they reappear in other places along the back.

The Live-stock Division :—

This trouble is due to inflammation of the sebaceous glands and hair-follicles, with retention of their secretion, which not infrequently causes pus-formation. It is usually produced on horses' backs by badly fitting and dirty saddles. When the boils or pimples make their appearance the parts should be well fomented with hot water to which a disinfectant has been added. When the pimples begin to discharge they should be kept clean and touched up daily with a little undiluted carbolic acid. After recovery, care should be taken that the lining of the saddle is thoroughly disinfected and the saddle made to fit properly, otherwise reinfection may take place. Salines, such as hyposulphide of soda, given daily in 1 oz. doses will also have a beneficial effect. The animals will eat this freely if crushed fine and put in their feed.

PINUS INSIGNIS TIMBER FOR BUILDING.

G. TEBBS, Tauranga :—

Can you give me any information as to the suitability of *Pinus insignis* timber for building purposes. The general impression in this district is that the borer would soon get into it. Would it be of advantage to dress the timber with Solignum or creosote? Any information would be gladly received.

The Horticulture Division :—

The timber of *Pinus radiata* (*insignis*) is being quite extensively used for the construction of buildings, especially in the South Island. Some buildings have been erected for a number of years, and so far we have heard of no report of borer attack. A dressing of benzine, 5 parts, to creosote, 1 part, is recommended as being protective against borers. Care in selection of the timber, using no sap-wood, and felling the trees in winter, will have good deterrent effect.

COWS WITH FOOT TROUBLE.

A. W. B., Teddington :—

Three of my cows are suffering with some trouble in their feet. They first went extremely lame, their feet swelling up just above the hoof. After a time the swelling burst, and with the discharge the pain ceased, but the places are still open and raw. Could you give me any information as to this disease and its treatment?

The Live-stock Division :—

The trouble you describe as affecting your cows is, in all probability, the condition known as "foul-in-the-feet" of cattle. It is more common in wet, marshy places, and very often a change to dry ground causes it to disappear. As regards treatment, you should endeavour to get the feet into as clean a condition as possible. Bathe the parts you describe as "open and raw" above the horn with hot water containing a little antiseptic, such as Jeyes Fluid or Kerol. Afterwards a lotion made by dissolving 1 oz. of sulphate of zinc in a quart of water should be applied once daily.

BLACK BEES FROM THE BUSH.

R. H. CROZIER, Palmerston North :—

Can you recommend the small black bee we find in the bush as a good honey-bee? I know of three strong colonies of them, and if they are worth taking I shall hive them.

The Horticulture Division :—

The black bees found in the bush are from the original bees imported from England, and are good honey-gatherers, but the Italian race has come into more general favour.

CONTROLLING TOP GROWTH OF APRICOT-TREES.

MRS. E. WRIGHT, Puriri :—

Can you advise me how to prevent apricot-trees from making too much top growth? I have some eight-year-old trees which did not grow much at first, but have made from 8 ft. to 10 ft. of wood this year. The more they are pruned the more top growth they make. I wish to keep them down, as I find it impossible to pick the fruit from some of my trees, which are thirty-five years old and 30 ft. high.

The Horticulture Division :

Apricot-trees usually make strong growth after pruning. This habit is useful while a tree is young, but is likely to be troublesome when the trees attain to a height at which it is desirable they should remain. There are two ways of preventing strong growth and still keeping the tree in the desired form. One method is to prune toward the end of December, in which case the leaders should be pruned to a bud at about the desired height. The resulting growth will be weak, and will remain so thereafter. The other plan is to shorten in winter to a lateral instead of to a bud.

CRACKS BETWEEN COWS' TOES.

GEORGE IRVING, Henley, Otago :—

Kindly inform me what is the best treatment for cracks between the toes of cows. I have two cows very lame with this trouble. Their feet have a very bad smell.

The Live-stock Division :—

Good treatment for cracks between the toes of cows consists in cleansing the part thoroughly with warm water and disinfectant, then applying a mixture of powdered bluestone (1 part) and glycerine (7 parts). This should be repeated daily. The cows must be kept on dry, clean pasture. Wet boggy ground and mud is usually the cause of the trouble. Powdered fresh unslaked lime dusted between the claws is often used with beneficial effect, the interdigital space being first cleaned.

PROTECTING FRUIT-TREES FROM RABBITS.

"SUBSCRIBER," Puketiro :—

Kindly advise whether there is any simple home-made solution that one could paint on apple-trees to make the bark distasteful to rabbits; also, in the case of the bark having been chewed off in places, what should one put on to help it to heal?

The Horticulture Division :—

There are various mixtures that can be applied, and which are fairly effectual. The chief difficulty, however, is that as in this country trees are usually branched low, the rabbits (or hares) are able to reach up and eat the young shoots, which they will do if the trunk bark is made distasteful to them. There is really no effectual method of protection except to shut them out by the use of wire netting. The

following are useful mixtures: Cow-manure, lime, and water; cow-manure, sand, and water; sulphur, soot, and lime. In each case the mixtures should be made into a thick paint and applied with a brush. Stockholm tar is also useful (gas-tar must not be used). Where the bark has been gnawed off the bare wood may be covered with either Stockholm tar, grafting-wax, or white-lead and oil paint. Any of these will exclude weather and assist healing.

MAKING CANDIED LEMON-PEEL.

A. HUTCHINSON, Silverdale:—

Please state a simple way to make candied peel. We have the lemons, and commercial lemon-peel is unprocurable.

The Horticulture Division:—

The peel is first soaked in brine for ten to fourteen days, or longer if required. Strain and wash thoroughly, preferably in running water. Make a syrup at the rate of 10 lb. sugar to 1 gallon water, and boil until it will just form a thread. While boiling put in the peel, and continue boiling for two or three minutes. Let stand for several hours. Drain the peel, reboil the syrup, and again put in the peel, continuing to boil for two or three minutes. Repeat this five or six times. Then place the peel in dishes, pour a small quantity of syrup into each piece, and place in a warm place to dry, either in the sun or an artificially heated drying-room.

PIGS WITH PROTRUDING BACK PASSAGES.

J. W. L., Otaki:—

Of twenty weaner pigs, about three months old, I have had five with their back passages blown out and hanging down. I have washed, oiled, and carefully replaced the parts, leaving the pigs without food for a day, but as soon as the operation is over the parts again protrude. The pigs are fed twice a day on thick sour milk. Please advise me as to the cause of and remedy for this ailment.

The Live-stock Division:—

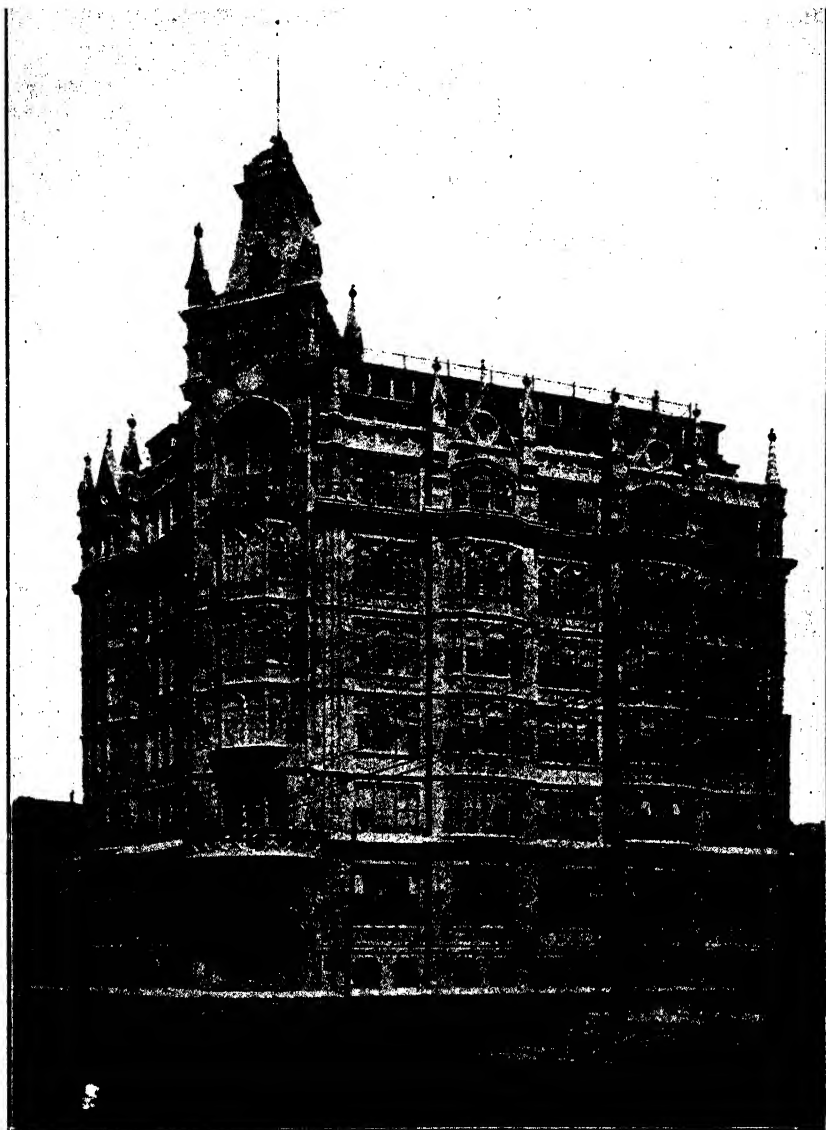
The condition you describe affecting your pigs is directly caused either by straining or intestinal irritation. Thick sour milk cannot be recommended under the conditions: fresh separated milk would be much more suitable. The back passages will require to be replaced until all excessive straining ceases, the procedure you adopt being quite correct. Strict attention should be given to the feeding-utensils as regards cleanliness, and the pigs should be kept warm, dry, and free from draughts.

NOTICE.—An inquiry from Taneatua, regarding Californian thistle, cannot be answered unless name of sender is supplied.

FORTHCOMING AGRICULTURAL SHOWS.

Hawke's Bay A. and P. Society: Hastings, 23rd and 24th March (Autumn Show).
Oxford A. and P. Association: Oxford, 8th April.
Methven A. and P. Association: Methven, 15th April.
Malvern A. and P. Association: Sheffield, 15th April.
Clutha Valley A. and P. Society: Greenfield, 5th May (Winter Show).
Manawatu and West Coast A. and P. Association: Palmerston North, 22nd to 25th June (National Dairy Show).

Unidentified Subscription.—A postal note, No. 477943, dated Palmerston North, 29/1/20, has been received without further advice. The sender should communicate with the Publisher, Department of Agriculture, Wellington.



THE DOMINION FARMERS' INSTITUTE, WELLINGTON.

This fine building, recently completed, has become the headquarters of the Farmers' Union, the Council of Agriculture, the Farmers' Co-operative Wholesale Federation, the National Dairy Association, the Forestry League, &c. The Board of Agriculture, the Forestry Department, the Farmers' Co-operative Distributing Company, and several other agricultural concerns also have offices in the building. The conference hall is now used for practically all gatherings of the various Dominion agricultural organizations when meeting in Wellington.

REVIEWS AND NOTICES.

THE LIMESTONE RESOURCES OF NEW ZEALAND.

A RECENT publication issued by the Geological Survey Branch of the Mines Department is Part I of Bulletin No. 22 (New Series), entitled "The Limestone and Phosphate Resources of New Zealand," with the parenthetical subtitle "Considered principally in relation to Agriculture." The author is Mr. P. J. Morgan, Director of the Geological Survey, assisted by Dr. J. Henderson and Messrs. M. Ongley, J. E. Harris, and F. Fulton-Wood, officers of the Survey staff. The preparation of the bulletin was undertaken at the request of the Department of Agriculture, which, in the interests of the agricultural industry, desired a comprehensive report on the limestone deposits of the Dominion. Part I of the bulletin, now published, deals with limestone only, giving a full summary of all available information concerning the various known deposits in the Dominion, each county being dealt with separately. Preceding this matter is a chapter of general information on the subject of limestone and lime, some extracts from which are published elsewhere in this issue of the *Journal*. This part of the publication, dealing in a clear and simple manner with the agricultural, chemical, geological, and other branches of the subject, would in itself form an excellent bulletin or handbook of moderate compass. It is stated that Part II is to consist mainly of a general account of the plant and machinery used in the calcination and the crushing of limestone, followed by a description of the phosphate deposits of New Zealand. Part I, it may be mentioned, is a crown quarto volume of 316 pages of letterpress, together with fourteen plates, six text-figures, and two maps, bound in quarter-cloth boards. The publication is one eminently suitable for the libraries of bodies such as farmers' unions and agricultural associations. It may be procured from the Government Printer, Wellington, at a price of 5s. A limited edition only has been printed.

THE STATE FORESTRY REPORT, 1918-19.

DURING last parliamentary session appeared the first annual report of the newly constituted Department of Forestry—really the first yearly State forestry report for New Zealand. Previous to this forestry had been a branch of the Lands Department, and had concerned itself with little more than exotic timber plantations outside the boundaries of the indigenous forests. Forestry in New Zealand to-day may be defined as the building-up of national forest estates out of the rough-and-tumble forestal chaos of the past. One of the first steps in serious forestry taken by Sir Francis Bell, Commissioner of State Forests, was to ascertain what were the forests still left to the State. The report under review gives what is perhaps the first reliable information yet published on that very important point. The total area of forest now owned by the State is stated at about 10,478,247 acres. This is actually 15.9 per cent. of the total area of the Dominion, as against the 25 per cent. considered necessary in other well-populated civilized countries; against 35 per cent. achieved in that highly industrialized area, the Rhine Valley; and against 65 per cent. aimed at in the forest policy of Japan.

This area of 10,500,000 acres owned by the State requires the early attention of the people and Parliament in two particulars. Firstly, only 1½ million acres of the total is now considered millable, and thus able, when in charge of foresters, to pay profits on its working and rejuvenation. The rest, to be put in order as a productive property, will require expenditure on roads, nurseries, and buildings, together with the settlement of population. For this we must be prepared to find funds or to suffer the reproach and loss attendant on unproductive or poorly productive areas

in our midst. Secondly, of the area of 10,500,000 acres, only 1,654,214 acres when the report was published were under the Commissioner of Forests and the Forestry Department [some additions have since been made]. The fate of the national forest area will be watched with interest in future departmental reports. There will be additions to it in Maori lands bought up (mostly from the Urewera country); there will also be subtractions as areas suitable for agriculture are cut off in the process of forest demarcation. Details of the forest areas in scenic reserves, national parks, national-endowment lands, and milling-areas are given. Actually these are parts of the 10,500,000 acres, much of which has been allowed to become burdened with rights.

The timber plantations of exotics have been continued on the lines of previous years, but with better supervision and a correction of the faults reported in the Forest Commission Report of 1913. The total area planted up to date is 35,444 acres, of which two-thirds is in the North Island on pumice land. The economic position of planting timber on easily ploughable pumice lands may be open to question, but in the South Island the economic position is stronger both as regards quality of soil and accessibility, especially since the opening of the new plantation at Balmoral on very poor soil, and on the Culverden railway-line. Prison labour is now confined to one station on the Kaingaroa Plains. A well-organized tree-planting camp for returned soldiers (named Waireka) was formed near the Waitotapu Plantation. It affords outdoor employment on a healthy site, and may develop into a forest settlement. The most urgent matter now facing the plantations is to replace the present casual labour by that of permanent settlers on small farms in the neighbourhood. In the early days it was not realized that forestry means continuous labour—that it is not merely planting a tree to-day and cutting it forty or fifty years hence.

The forest revenue for the year was £26,375, but of this only the sum of £4,937 was paid into the State Forest Account. With book-keeping such as this—and it has been the same for many years past—the forest finance of the Dominion remains an unknown quantity. The expenditure seems to have amounted to about £42,000, deducting the merely book entries shown in the statement. There was a special forest vote of £200,000, and the comparative small amount of forest work accomplished during the year was due to delay in getting together a forest staff, which in this report is forecasted at one research officer and six forest inspectors, together with the office staff in Wellington. The rank and file of the Department, consisting of resident foresters and rangers, remains for the future. The active organizing of the forests into working units has not yet begun.

The report describes several important departures which can only be touched upon in this brief review. Regulations have been made which are some advance towards a valid Forest Act for New Zealand. Provisional State forests—lands reserved pending regular forest demarcation—have been set on foot, and 1,800,000 acres were ready for proclamation at the close of the year under report. The anomaly of Mining Wardens possessing destructive forest powers has been reduced but not abolished.

The year's output of sawn timber in the Dominion amounted to nearly 228 million superficial feet, of which almost exactly one-half was rimu; the output of kauri was under one-tenth that of rimu. Something like 15 million superficial feet of timber may have been imported during the year, but, the accounts not being kept in one unit, the exact amount cannot be ascertained. Government sawmilling is to be commenced in one of the State kauri forests.

A report on the demarcation and management of the Waipoua Kauri Forest by Mr. (now Sir) D. E. Hutchins was published during the year. The author has had a long experience of this class of forest, and maintains that it can easily be worked and much improved by ordinary forest methods. He indicated at the last annual meeting of the Forestry League that something like £85,000 yearly is being lost in postponing the working and rejuvenation of this forest, which is full of over-mature timber. There is also a staff occupied at present only on police work, which is costing some £575 per year. When the forest is worked and developed this police work will become nearly automatic and costless.

The useful distribution of forest-trees and seeds at cost price was continued, 420,412 young trees and a small quantity of seed being sold to farmers and local bodies. The issue of rooted plants in trays is being largely adopted. It much reduces the tree-planter's risks.

A burning question during the year has been the increased limitation of the export of white-pine timber. Measures were taken through the Board of Trade to limit the export of this timber to 40 per cent. of the total production. Strong representations to both increase and decrease this limit were received. The real position, as to whether in any given forest or group of forests it is more advantageous to work off the old timber and put a timber-increment on the forest, or to keep the forest unworked like gold in a stocking, an idle capital but a necessary reserve—the exact economic position in any given forest—cannot be ascertained until the Forestry Department is much stronger than at present. In the meantime the cautious policy of restricting export seems to be obviously the wiser one.

Some pertinent observations are made on the rate of growth of native trees. The initiation of the great work of interplanting seedlings in the native forest to grow up as standards and improve the stocking is also recorded.

The report, which may be regarded as historical as the first of a series, is submitted by Mr. E. Phillips Turner, for a number of years connected with the Forestry Branch of the Lands Department and now Secretary of the Forestry Department. It shows a notable advance in New Zealand forestry, and comes as a happy augury for the successful work of the technically trained Director of Forestry, Captain L. M. Ellis, who arrives this month from overseas to take up his appointment.

FRUIT-EXPORT REGULATIONS.

THE following regulations relating to the export of fruit from New Zealand, made by Order in Council under the Orchard and Garden Diseases Act, were gazetted on 4th March, and came into force on the same date:—

REGULATIONS.

1. In these regulations, if not inconsistent with the context,—

"Appointed store" means a store appointed by the Minister for the inspection and examination therein of fruit for export.

"Blemish" means an injury detrimental to the appearance of fruit, and includes branch-rubs, scratches, insect-bites, unnatural russeting, bruises, excrescences, sun-scalds, and hail-marks, but does not include spray injury.

"Brand" means to mark clearly and legibly by stencil, imprint, or label.

"Clean" means free from dirt, insect-stains, and spray-stains.

"Director" means the Director of the Horticulture Division of the Department of Agriculture.

"Export brand" means an export brand registered by the owner of fruit for export in accordance with the provisions of these regulations.

"Fruit" means apples, pears, or peaches.

"Inspector" means an officer of the Department of Agriculture authorized to examine fruit for export in accordance with these regulations and duly appointed an Inspector under the Orchard and Garden Diseases Act, 1908.

"Mature" means having the degree of ripeness suitable for export.

"Owner" means any owner, shipper, or consignor of fruit, and includes the agent or servant of any such owner, shipper, or consignor, and also includes, in the case of a company, the managing director, manager, director, secretary, or other principal officer of the company in New Zealand.

"Pack" means to regularly and compactly arrange fruit in a package.

"Package" means a container for fruit.

"Size" means, when used as a noun, the diameter of fruit measured from cheek to cheek at the widest part, and when used as a verb means to sort according to size.

"Solid red variety" means any of the varieties of apples so designated in lists of varieties approved for export published in the *Gazette* as hereinafter provided.

"Spray injury" means the russeting of, or other injury to, fruit as the result of spraying.

"Standard bushel case" means a case of the following dimensions (inside measurements): Length, 19½ in.; depth, 10 in.; width, 11½ in. The thickness

of timber used in the construction of the cases shall be $\frac{3}{4}$ in. for the ends and $\frac{1}{8}$ in. for the sides, tops, and bottoms. Provided that on written application being made to him by the owner the Director may, if satisfied as to its strength, allow thinner timber to be used for the tops and bottoms of the cases, or may allow thin timber adequately strengthened by cleats to be so used.

"Standard half-bushel case" means a case of the following dimensions (inside measurements): Length, $19\frac{1}{2}$ in.; depth, 5 in.; width, $11\frac{1}{4}$ in. The thickness of timber used in the construction of the case shall be the same in all respects as for the standard bushel case.

"Striped or partial red variety" means any of the varieties of apples so designated in lists of varieties approved for export published in the *Gazette* as hereinafter provided.

"Yellow or green variety" means any of the varieties of apples so designated in lists of varieties approved for export published in the *Gazette* as hereinafter provided.

2. No fruit shall be exported from the Dominion unless it has been passed for export by an Inspector, and unless all the provisions of these regulations have been complied with.

3. (1.) Only such varieties of fruit as are approved by the Minister shall be exported from the Dominion. Such approval in regard to any variety may permit the export either generally or to any specified country or countries only. (2.) Notification of the varieties which have been approved as aforesaid shall be published in the *Gazette*.

EXPORT BRAND.

4. Every package of fruit exported from the Dominion must be branded with the registered export brand of the owner of such fruit.

5. Every person who exports or intends to export fruit from the Dominion shall apply to the Director for the registration of an export brand, enclosing with his application a facsimile of the brand he desires to register.

6. (1.) Every export brand shall contain the particulars set out in the First Schedule hereto. (2.) The size of the export brand shall coincide as nearly as possible with the size of the end of the package on which it is to be branded, but the prescribed particulars shall be displayed in characters of not less than 1 in. block type for the name of the kind of fruit and of not less than $\frac{1}{4}$ in. or more than $\frac{3}{4}$ in. block type for the other particulars. (3.) There may be used in conjunction with the prescribed particulars a design or other particulars.

7. If the application for registration of an export brand is in order, and if in his opinion the use of such export brand is not likely to lead to mistakes or confusion, the Director shall register such export brand, and shall notify the applicant in writing accordingly.

8. No person shall use any export brand unless and until he has been notified by the Director in writing that it has been registered.

9. No person shall alter, by addition, deletion, or in any other way, the non-variable particulars of a registered export brand without the consent of the Director first had and obtained in writing.

10. The Director may at any time, after giving one month's notice in writing to the owner thereof, cancel the registration of any export brand if satisfied that it has not been used during the preceding two years in connection with the export of fruit.

GRADES OF FRUIT.

11. The following are the grades of fruit which may be exported from the Dominion:—

Extra Fancy Grade,
Fancy Grade;

and the words "Extra Fancy" and "Fancy" shall be known as and are herein referred to as "grade-marks."

APPLES.

12. The following are the standards by which the grade of apples shall be determined:—

Extra Fancy Grade.—Apples of this grade shall be of not less size than $2\frac{1}{4}$ in., sound, smooth, and clean. They shall be mature, well formed, hand-picked, true to name, and free from disease, spray injury, visible bitter-pit, skin-puncture or skin broken at stem, and other defects. Very slightly blemished apples may be included in this grade, provided that not more than 8 per cent. of the total number in any one package are so blemished. The individual apples of solid red and

striped or partial red varieties shall carry not less than 75 per cent. and 50 per cent. respectively of good typical colour. The individual apples of yellow or green varieties shall be of good characteristic colour.

Fancy Grade.—Apples of this grade shall be of not less size than $2\frac{1}{4}$ in., sound, smooth, and clean. They shall be mature, well formed, hand-picked, true to name, and free from disease, visible bitter-pit, skin-puncture or skin broken at stem, and other defects. Slightly blemished apples may be included in this grade, provided that no individual apple shall have more than 5 per cent. of its surface affected thereby. Apples affected by spray injury may also be included in this grade, provided that no individual apple shall have more than 5 per cent. of its surface affected thereby. The individual apples of solid red and striped or partial red varieties shall carry not less than 50 per cent. and 25 per cent. respectively of good typical colour. The individual apples of yellow or green varieties shall be of good characteristic colour.

13. (1.) No apple shall be deemed to fall in either of the above grades if, notwithstanding that in other respects they conform to the standards set out, they have been taken from trees which have been planted out in the orchard less than seven years, and no such apples shall be exported. (2.) If an Inspector examining fruit for export as hereinafter provided has reason to doubt whether any apples submitted for examination are from trees which have been planted out in the orchard at least seven years, he may require the owner of such apples to furnish a statutory declaration that they are from such trees.

14. The following are the standards by which the grade of pears shall be determined:—

Extra Fancy Grade.—Pears of this grade shall be of not less size than 2 in. if pyriform in shape and $2\frac{1}{4}$ in. if round in shape. They shall be clean, sound, clear-skinned, and of bright appearance. They shall be mature, well formed, hand-picked, true to name, and free from disease, spray injury, skin-puncture or skin broken at stem, and other defects. Very slightly blemished pears may be included in this grade, provided that not more than 8 per cent. of the total number in any one package are so blemished.

Fancy Grade.—Pears of this grade shall be of not less size than 2 in. if pyriform in shape and $2\frac{1}{4}$ in. if round in shape. They shall be clean, sound, mature, well formed, hand-picked, true to name, and free from disease, skin-puncture or skin broken at stem, and other defects. Slightly blemished pears may be included in this grade, provided that no individual pear shall have more than 5 per cent. of its surface affected thereby. Pears affected by spray injury may be included in this grade, provided that no individual pear shall have more than 20 per cent. of its surface affected thereby. Pears having characteristic russetting shall not be deemed to be unfit for inclusion in this grade.

15. The following are the standards by which the grade of peaches shall be determined:—

Extra Fancy Grade.—Peaches of this grade shall be of not less size than $2\frac{1}{4}$ in., well formed, true to name, free from disease and blemish, and exceptionally well coloured according to variety.

Fancy Grade.—Peaches of this grade shall be of not less size than $2\frac{1}{4}$ in., well formed, true to name, free from disease and blemish, and of good colour according to variety.

PACKING OF FRUIT.

16. Prior to being placed in packages fruit shall be sized, and only fruit of as nearly as possible the same size shall be packed together in a package.

17. In sizing fruit in any particular size for the purpose of packing a variation of not more than $\frac{1}{4}$ in. above the size in question will be allowed; but no fruit shall be included in a package which is of less size than that set out in the owner's registered export brand hereinafter required to be branded on such package.

18. Fruit of one grade only shall be packed in each package. Provided that fruit of different grades may be contained in the same package if the grade-mark to be placed on the package as hereinafter prescribed is that of the lower grade of fruit contained in such package. Provided further that nothing in this clause

shall be construed to authorize the packing-together in one package of fruit of different kinds or of different varieties of the same kind of fruit.

19. (1.) All fruit for export shall be properly wrapped in new paper having one or both surfaces glazed or in some other paper approved by the Director. (2.) Not more than two papers shall be wrapped round any one fruit.

20. (1.) Wood-wool or corrugated strawboard shall be placed at the top and bottom of each case or tray in which the fruit is packed, but in such quantities only as shall be necessary for the protection of the contents. (2.) If in his opinion the quantity of wood-wool or corrugated strawboard used is excessive, the Inspector may reject the package for export until the matter has been remedied.

21. All fruit for export shall be properly packed on the diagonal or pocket pack system.

22. All fruit for export must be packed in clean new packages, which must be properly constructed of well-seasoned timber.

23. The following are the types of packages which shall be used for the packing of fruit for export.

Apples.

(1.) Apples for export shall be packed in standard bushel cases.

Pears and Peaches.

(2.) Pears or peaches for export shall be packed in one of the following types of packages:—

(a.) A standard half-bushel case. (b.) A package of three wooden trays strapped together, one above the other, each tray having an inside measurement of $11\frac{1}{2}$ in. by $19\frac{1}{2}$ in., with a depth of from $2\frac{1}{2}$ in. to 3 in. The straps shall be of wood $\frac{1}{2}$ in. thick and $1\frac{1}{2}$ in. wide, secured to the ends of the trays, two straps to each end and flush with the sides of the package thus formed. The timber used for the construction of trays shall be of the same thickness as that prescribed for the standard bushel case. The method of strapping the trays is shown in the diagram set out in the Second Schedule hereto.

BRANDING OF PACKAGES OF FRUIT.

24. Every package of fruit for export shall, before being sent to an appointed store for examination as hereinafter provided, be branded with the registered export brand of the owner of such fruit.

25. The particulars in the export brand placed on any package of fruit relating to the grade, size, number, or variety of such fruit shall accurately describe the contents of such package, provided that a variation of not more than five per package shall be allowed in the number of fruit stated to be in such package.

26. No other brand or mark shall be placed on any package of fruit to indicate the grade or quality of the contents of such package than the grade-marks "Extra Fancy" and "Fancy" hereinbefore set out.

27. No other brand or mark shall be placed on the same end of a package of fruit as the registered export brand.

EXAMINATION OF FRUIT AT APPOINTED STORES.

28. (1.) The owner of fruit for export shall forward it, duly graded, packed, branded, and otherwise dealt with in accordance with the provisions of these regulations to an appointed store not less than two working-days before shipment.

(2.) He shall at the same time give to the Inspector at the appointed store to which the fruit has been sent an advice-note in the form set out in the Third Schedule hereto or to the effect thereof.

29. Every owner of fruit sending the same to any of the appointed stores shall make his own arrangements for the transit of the fruit to and from the store, and also for its receipt, storage, opening up for examination, repacking, delivery, shipment, and any other service, including insurance and protection from damage or loss of any kind.

30. (1.) For the purpose of determining whether the particulars set out in the export brand thereon correctly describe the contents of packages of fruit submitted for examination at an appointed store, and whether all other requirements of these regulations in respect of such fruit have been complied with, the Inspector shall cause to be opened for examination 5 per centum of the packages in each line of fruit of the same variety and grade under the same export brand submitted, or such further number as he deems necessary. (2.) The decision of the Inspector in regard to the whole line shall be based on the result of his examination

of the packages so opened, being in no case less than 5 per centum by number of the line as aforesaid.

31. If after examining such fruit the Inspector is satisfied that the particulars set out in the export brand correctly describe the contents of the packages, and that all the other requirements of these regulations in respect of such fruit are complied with, he shall stamp each of the packages with a stamp (herein called the "official export stamp"), indicating that the contents have been officially passed for export, and shall issue to the owner of such fruit an export certificate in the form set out in the Fourth Schedule hereto.

32. (1.) If after examining such fruit the Inspector places it in a lower grade than that set out in the export brand on the packages he shall regrade such fruit, and shall cause to be erased the grade-mark on the packages. (2.) If in such regrading the grade is reduced from "Extra Fancy" to "Fancy" grade the Inspector may, on request from the owner of such fruit, have the grade allotted by him branded on the packages, and shall then stamp such packages with the official export stamp, and shall issue an export certificate as hereinbefore provided. (3.) Failing such a request, or if in such regrading the grade is reduced below the standard of "Fancy" grade, the Inspector shall reject such fruit for export.

33. If after examining such fruit the Inspector is of opinion that the particulars set out in the export brand on the packages of such fruit, other than those relating to grade, do not correctly describe the contents of such packages, or that any other requirements of these regulations in respect of such fruit have not been complied with, he shall reject such fruit for export.

34. Notwithstanding the foregoing provisions as to the rejection of fruit for export, nothing in these regulations shall be deemed to forbid individual fruits taken out of packages of fruit rejected for export being repacked and resubmitted at an appointed store if such individual fruits comply with the requirements of these regulations.

35. If any fruit sent to an appointed store is found to be diseased or infected fruit the Inspector shall condemn such fruit, which shall be destroyed or otherwise dealt with as the Inspector directs. The expense of such destruction or treatment shall be borne by the owner of the fruit.

36. Notification of any regrading, rejection, or condemnation of fruit for export shall be made immediately to the owner of such fruit by the Inspector.

37. No person shall remove from any appointed store, except for the purpose of immediately shipping it beyond New Zealand, any fruit for which an export certificate has been issued unless the export certificate is surrendered to the Inspector and the official export stamp upon the package or packages containing such fruit has been erased or cancelled to the satisfaction of the Inspector.

38. If any fruit which has been examined by an Inspector and passed for export has become, prior to its export from the Dominion, damaged, or in the opinion of an Inspector has deteriorated, the owner of such fruit shall, if and when directed by an Inspector to do so, submit such fruit for re-examination, and shall on demand surrender to the Inspector the export certificate issued in respect thereof.

39. In respect of fruit submitted for examination at an appointed store the decision of the Inspector as to grade, packing, branding, or other compliance with the provisions of these regulations shall be conclusive, and no action or other proceedings shall lie against an Inspector or other officer of the Crown, or against the Crown, in respect of any erroneous decision of the Inspector.

PENALTIES.

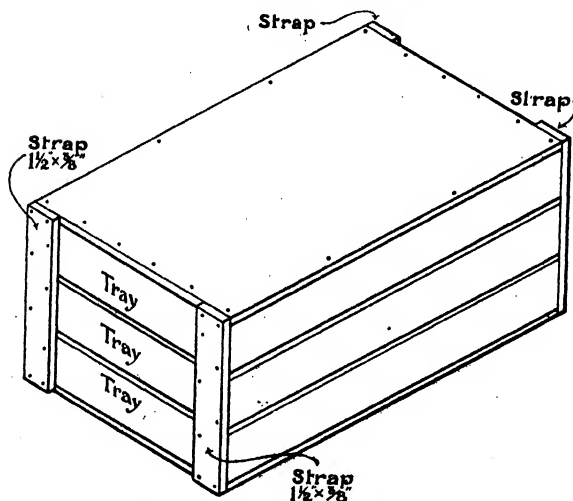
40. Every person who—(1) Forwards to an appointed store any fruit which is noticeably at variance in any particular with the description of such fruit set out in the export brand on the packages containing the same; or (2) forwards to an appointed store any fruit which is diseased or infected; or (3) exports or attempts to export, or forwards to an appointed store, any apples taken from trees which have not been planted out in the orchard at least seven years; or (4) exports or attempts to export any fruit which has been rejected for export by an Inspector or for which no export certificate has been issued; or (5) exports or attempts to export or is concerned in exporting any fruit of a variety approved for export to a specified country or countries only, to any other country; or (6) except as otherwise provided in these regulations, alters or obliterates wholly or partially, or causes to be altered or obliterated, any official export stamp on any package of fruit, or counterfeits or improperly impresses any official export

stamp on any package of fruit for export; or (7) commits or is concerned in committing any breach of these regulations, shall be liable to a penalty not exceeding £20.

FIRST SCHEDULE.—(REG. 6.)
EXPORT BRAND FOR FRUIT.

NEW ZEALAND [<i>State kind of fruit.</i>] Variety : Grade : Size of fruit : Number of fruit in package : Packed for export.
--

SECOND SCHEDULE.—(REG. 23.)



A Package of Three Trays strapped—End View.

THIRD SCHEDULE.—(REG. 28.)

ADVICE-NOTE SUBMITTING FRUIT FOR EXAMINATION PRIOR TO EXPORT.

The Fruit Inspector,
Department of Agriculture,

.....
IN compliance with the regulations under the Orchard and Garden Diseases Act, 1908, and its amendments. I hereby submit for examination the undermentioned fruit for export, which I have forwarded this day per _____ to the appointed store belonging to _____ at _____

Please send the export certificate to _____

Shipping-mark.	Registered Export Brand.	Number of Cases.	Kind of Fruit.	Variety of Fruit.	Grade.	Size.

(Address and date.)

(Signature.)

FOURTH SCHEDULE.—(REG. 31.)

EXPORT CERTIFICATE FOR FRUIT.

I HEREBY certify that I have this day examined the undermentioned packages of _____, and, having found the contents free from disease and in conformity with the description branded on the packages, have passed them for export, and have stamped the packages with the official export stamp.

Number of Cases.	Kind of Fruit.	Variety.	Grade.	Export Brand.	Shipping-mark.

(Place and date.)

, Inspector.

VARIETIES OF FRUIT APPROVED FOR EXPORT.

IN terms of the foregoing regulations the following varieties of fruit have been approved for export by the Minister of Agriculture :—

APPLES.

Solid Red Varieties.

Tasma.

Spitzenberg.

Striped or Partial Red Varieties.

Adams Pearmain.
Cox's Orange.
Delicious.
Gravenstein.

Jonathan.
Ribston Pippin.
Rome Beauty.
Scarlet Nonpareil.

Scarlet Pearmain.
Statesman.
Worcester Pearmain.

Yellow or Green Varieties.

Cleopatra.
Dunn's Favourite.
Golden Pippin.

London Pippin.
Newtown Pippin.
Parlin's Beauty.

Reinette du Canada.
Sturmer Pippin.
Willie Sharp.

PEARS.

Beurre Bosc.
Beurre Capiaumont.
Beurre Clairgeau.
Beurre d'Anjou.
Doyenne du Comice.

Directeur Hardy.
Durondeau.
Giblin's Nelis.
Glou Morceau.
Josephine de Malines.

Marie Louise.
P. Barry.
Twylford's Monarch.
Winter Cole.
Winter Nelis.

PEACHES.

Elberta.
Hobbs's Late.
James's Cling.
Kalamazoo.

Kia Ora.
Lippiatt's Late Red.
Paragon.
Prizetaker.

Sea Eagle.
Sea Eagle Improved.
Solway.
Wheatland.

GOVERNMENT GUARANTEE AS TO EXPORT OF FRUIT.

In a *Gazette* notice, dated 16th February, 1920, the Minister of Agriculture notified that the Government guarantees to shippers a net return of 1d. per pound net weight on all fresh fruit exported from New Zealand during the present season, provided that the guarantee shall apply only to shipments complying with the Government stipulations and covered by a Government Inspector's certificate.

Areas in Orchards, Gardens, Plantations, &c.—Particulars of the area in occupation in New Zealand under this class in 1918-19 (aggregated as 142,115 acres on the opposite page) are as follows: Commercial orchards—bearing, 14,182 acres; not bearing, 12,968 acres; orchards for private use only, 7,572 acres; vineyards, 213 acres; market gardens, 2,472 acres; nurseries and seed-gardens, 501 acres; private gardens and grounds about residences, 55,226 acres; plantations, 48,981 acres.

OCCUPATION AND USE OF LAND IN NEW ZEALAND: 1917-18 AND 1918-19.

—		1917-18.	1918-19.	Increase.	Decrease.
		Acres.	Acres.	Acres.	Acres.
Grain and pulse crops .. .. .	.. .. .	819,169	750,964	..	68,205
Grasses and clovers (cut for seed or hay), green and root crops .. .. .	.. .. .	884,146	820,035	..	64,111
Sown grasses (not cut for seed, hay, or ensilage) .. .. .	.. .. .	15,448,134	15,831,604	383,470	..
Fallow lands .. .. .	.. .. .	77,791	68,619	..	9,172
Gardens, orchards, plantations, &c. .. .. .	.. .. .	156,920	142,115	..	14,805
Unimproved land .. .. .	.. .. .	25,825,919	25,729,369	..	96,550
Totals .. .. .	.. .. .	43,212,079	43,342,706	130,627	..

DETAILS OF UNIMPROVED LAND: 1918-19.

Land District.	Phormium Tenax.	Tussock and other Native Grasses.	Fern, Scrub, and Second Growth.	Standing Virgin Bush.	Barren and Unproductive Land.	Total Unimproved Occupied Land.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
North Auckland	5,201	210,721	810,029	407,360	121,830	1,555,141
Auckland	11,194	435,049	1,001,829	731,545	63,197	2,242,814
Hawke's Bay	243	866,917	346,766	334,414	104,536	1,646,876
Taranaki	50	10,653	65,698	325,900	5,484	407,785
Wellington	19,249	502,302	282,345	448,560	91,660	1,344,116
Nelson	3,401	303,910	151,552	480,436	49,872	989,171
Marlborough	1,265	1,242,318	209,599	200,816	401,025	2,055,023
Westland	6,669	226,661	65,995	995,846	299,688	1,594,859
Canterbury	1,947	4,445,331	104,105	239,000	682,128	5,472,511
Otago	1,734	6,003,478	207,522	123,709	207,379	6,543,822
Southland	4,668	1,384,128	148,495	211,631	126,329	1,877,251
Totals	55,621	15,625,468	3,393,935	4,499,217	2,155,128	25,729,369

(From Agricultural and Pastoral Statistics: Government Statistician, 1919.)

IMPROVED WHEAT-SEED.

For the last ten years the authorities at Lincoln College, Canterbury, have been giving attention to the improvement of the different kinds of wheat commonly grown in New Zealand, and have distributed some strains which show considerable improvement over the commercial seed. The variety known as College Hunters or Red Chaff has now almost completely replaced the old Hunters grown five years ago, and a prolonged tour in mid-Canterbury did not reveal a single crop of this variety that was not grown from College seed. More recently improved strains of Pearl, Solid-straw Tuscan, and Purple-straw Tuscan have been distributed, and these have in nearly every case shown superiority over the old seed.

To keep up the supply of seed of these strains a Canterbury Seed-growers' Association was formed, and it has on hand seed of the varieties mentioned, each bag of which bears a certificate that it was inspected while growing, is true to name, relatively pure, and free from noxious weeds. Growers desiring seed of these strains should send applications early to Dr. F. W. Hilgendorf, Lincoln College, via Christchurch, who is acting as honorary secretary to the association.

DIATOMACEOUS AND SILICEOUS EARTHS.

DURING the past few years the writer has examined several specimens of diatomaceous or pure siliceous earths. In 1917 some excellent samples were sent in. The origin of these siliceous earths was difficult to account for, owing to the absence of any evidence of organized structure. Some specimens were submitted to New Zealand manufacturing firms, who reported favourably upon the material, and stated their willingness to adopt it in place of material which they had hitherto imported. The matter was mentioned in the annual reports for the years ending 31st March, 1917 and 1918. Since then some additional samples have been dealt with, and some have been utilized in glue-making and in one other industry which previously imported its kieselguhr or diatomaceous earth. Recently other material of this nature has been received, and on examination disclosed clearly the minute siliceous remains of a low form of life.

The position, therefore, appears to be that excellent samples of diatomaceous earth are available in widely scattered localities throughout the Dominion, and it is advisable that an endeavour should be made to utilize the more accessible deposits. Supplies of this material imported cost several pounds a ton, and in these days of high freights it might pay to give preference to the local supplies. This diatomaceous earth has many applications in the manufactures, and is used in glue-factories for filtering. It would probably be valuable as an insulating-material—very likely superior to pumice. It has also been used as an absorbent for nitro-glycerine in the manufacture of explosives.

The Department would be pleased to supply to any inquirers the names of those who have sent in samples of these earths.—*B. C. Aston.*

THE JOURNAL SUBSCRIPTION RATE.

OWING to the steadily increasing cost of production—chiefly in paper and other materials—it has been found necessary to raise the yearly subscription rate of the *Journal* from 2s. 6d. to 4s. The new rate will apply to all subscriptions, including renewals, from 1st April next. The charge for a single copy remains at 6d., but subscribers' extra copies will be 4d. instead of 3d. each. The Department, although much regretting the change, feels sure that subscribers will readily accept the position, and that the rural community would not desire an official agricultural publication of the class of the *Journal* to be maintained partially at the expense of the general taxpayer. It may be mentioned that the old rate of 2s. 6d. was fixed at the inception of the *Journal* in 1910.



The New Zealand Journal of Agriculture.

VOL. XX.—No. 4.

WELLINGTON, 20TH APRIL, 1920.

AN ECONOMIC INVESTIGATION OF THE MONTANE TUSSOCK-GRASSLAND OF NEW ZEALAND.

VI. FURTHER DETAILS REGARDING THE RELATIVE PALATABILITY FOR SHEEP OF VARIOUS PASTURE-PLANTS.

L. COCKAYNE, F.N.Z.Inst., F.R.S.

GENERAL.

TO the June, 1919, number of this *Journal* I contributed an account of an experiment conducted by me during the previous month of January, which was designed to pave the way for future experiments regarding the relative palatability for sheep of the various plants now composing the grassland of the South Island back-country sheep-stations. The experiment was carried out on the Conical Hill Reserve, Hanmer Springs, which is 25 acres in area, and at its highest point 1,770 ft. above sea-level. The plant covering of the reserve consists at its lower part chiefly of cocksfoot (*Dactylis glomerata*) and sweet vernal (*Anthoxanthum odoratum*), but the upper portion—the greater part of the area—is tussock-grassland similar in character to that which clothes the adjacent mountains up to a height of some 3,000 ft., and is closely related to the montane grassland of the South Island in general.

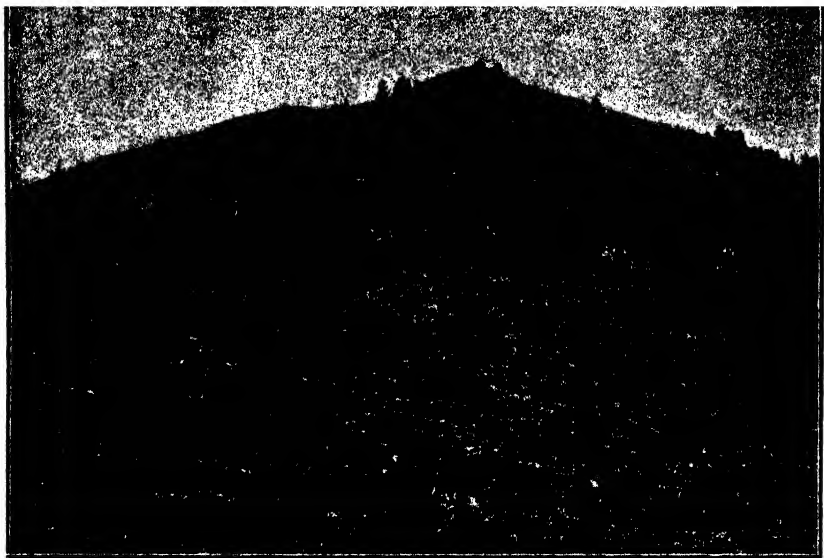


FIG. 1. GENERAL VIEW OF CONICAL HILL, SHOWING THE AMOUNT OF GROUND OCCUPIED BY TREES.



FIG. 2. A PURE STAND OF SWEET-VERNAL GRASS ON THE HILL.

This was cropped by the sheep as closely as if it had been mown. The tussocks of *Festuca novae-zelandiae* are untouched.

[Photos, W. D. Reid.]

The experiment consisted in the grazing of the reserve of 281 rams during a period of nine days, and observing exactly not merely which plants they ate and which they did not eat, but also paying special attention to the exact sequence in which the various plants were eaten. Obviously nine days was too short a time in which to procure full information regarding the relative palatability of all the plants; also the results obtained refer only to the class of pasture represented by that of Conical Hill as it then was under the climatic conditions of the particular season. Nevertheless, certain matters of general interest came to the front which indicated that much more research might be profitably carried out on the same lines, while it became evident that a good deal of current opinion regarding the palatability of well-known pasture-plants might not merely require modification but be erroneous. It also stood out clearly that much more knowledge was required regarding the value as sheep-feed of the following common pasture plants: Fescue-tussock (*Festuca novae-zelandiae*), poa-tussock (*Poa caespitosa*), blue-tussock (*Poa Colensoi*—in its various unnamed varieties), sweet vernal (*Anthoxanthum odoratum*), white clover (*Trifolium repens*) and suckling-clover (*Trifolium dubium*).

For further details regarding the original experiment reference must be made to the article in this *Journal* already cited, where there will also be found an account of what is meant by "relative palatability," together with certain details regarding palatability derived from field observations and a list of indigenous grasses showing what various authorities considered their palatability-value.

FURTHER OBSERVATIONS MADE AT CONICAL HILL.

During the middle of September, 1919, Mr. C. E. Christensen, Acting Tourist Agent at Hanmer Springs, gave permission for certain sheep to be pastured on the Conical Hill Reserve, which had been without stock for about eight months, except for a few rabbits. These sheep, 645 in number, were crossbred hoggets which had been travelling for fourteen days from Coalgate on their way to the Hossack Station, and were consequently extremely hungry when turned on to the pasture of the reserve. There they were allowed to remain for five days—i.e., during that period the pasture carried nominally twenty-six sheep to the acre. But this estimate gives no idea of the true state of affairs. A considerable portion of the reserve is taken up by paths, trees (see Fig. 1), and rocks. To this portion of the reserve, useless for grazing, may be added the bare ground—no small amount—and that occupied by actually unpalatable plants (see Fig. 6) and the dead leaves of the grasses, especially of the tussocks. Nor is this all, for the space taken up by the poa and fescue tussocks must be taken into consideration, since, as will be seen, they are of extremely low palatability. Therefore the actual area of fairly palatable food for the 645 hungry sheep would be very small indeed. Under such circumstances it might well be expected that the five days' grazing would make a strong mark on the pasture, and this was indeed the case in many places (see Figs. 2, 3, and 4); in fact, any plants which remained uneaten under such heavy stocking may confidently be considered either absolutely unpalatable or possessing an extremely low degree of palatability when in company with the particular species which were eaten.

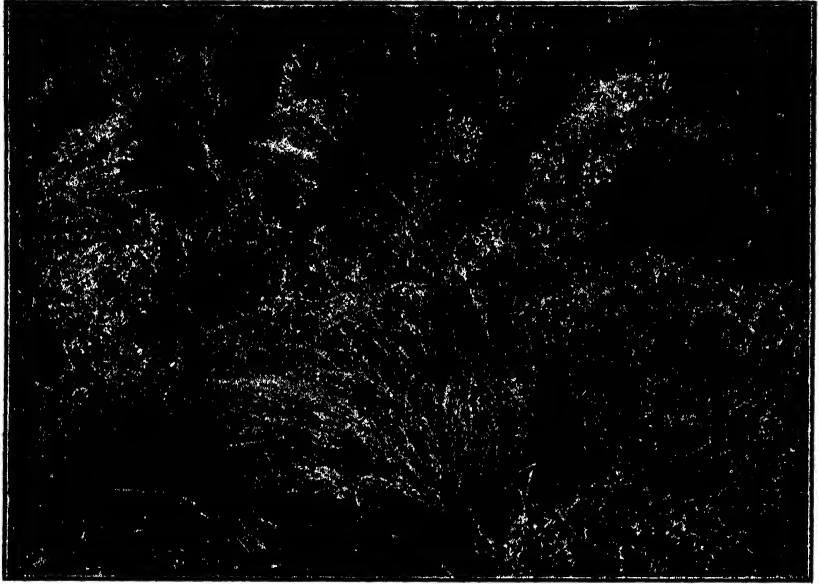


FIG. 3. VIEW OF SMALL PIECE OF LOWER PASTURE OF CONICAL HILL, SHOWING THE CLOSE GRAZING OF THE COCKSFOOT BETWEEN THE TUSSOCKS.

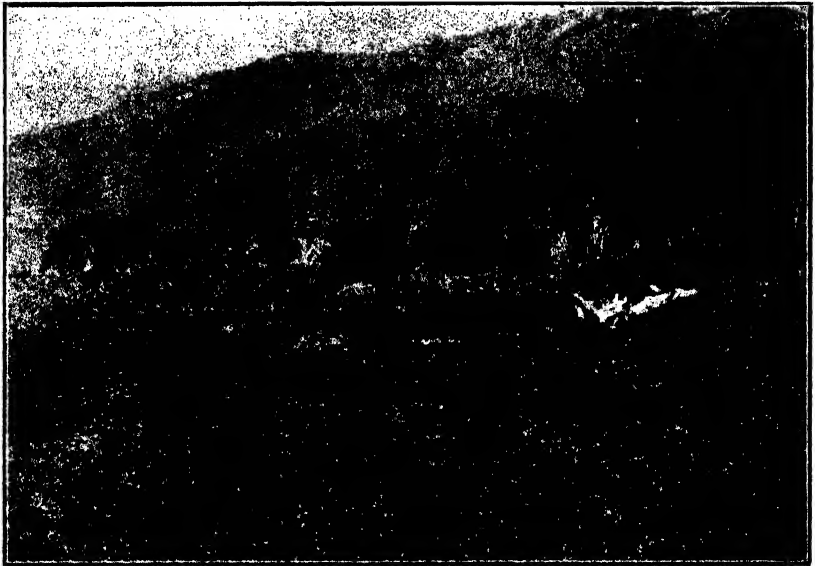


FIG. 4. THE CLOSELY GRAZED MEADOW-GRASS (*POA PRATENSIS*) ON THE SUMMIT OF THE HILL.

[Photos, W. D. Reid.]

Conical Hill was visited by me on 20th October, 1919—i.e., about thirty-six days after the sheep had been removed—and several subsequent visits were paid. At that time the pasture bore unmistakable signs of close grazing, certain grasses having been eaten to the ground; and in some places, where after the first experiment a close growth of uneaten grass remained, the grass was cropped as closely as if it had been mown with a scythe (see Fig. 2). On the other hand, where the tussocks originally predominated no difference was to be seen (see Fig. 5) unless examined closely.

Since I had no opportunity of seeing the sheep actually grazing nothing can be said regarding the relative palatability of the species eaten. All the species which had been freely eaten during the first experiment were again closely cropped. This was only to be expected. On this occasion the point of interest lay in those plants, already cited, which had been eaten either very slightly or not at all during the experiment of the preceding February. The degree to which these apparently more or less unpalatable species were eaten must be now considered, taking them in the order already given.

(1.) The poa-tussock (*Poa caespitosa*): In most instances poa-tussock was not eaten at all. This can be plainly seen from Fig. 7, where the untouched tussocks stand closely side by side bordering the path. Occasionally, however, poa-tussock was eaten slightly, but never to anything like the same extent as the far more palatable Yorkshire fog (*Holcus lanatus*) or catsear (*Hypochoeris radicata*) growing alongside. Evidently its palatability is extremely low, for it is greatly exceeded in this regard, as will be seen further on, by a grass of such poor palatability as sweet vernal (*Anthoxanthum odoratum*). On the other hand, there is conclusive evidence that the young leaves which appear after the tussock has been burned are of fairly high palatability.

(2.) The fescue-tussock (*Festuca novae-zelandiae*): The fescue-tussock appears to stand regarding its palatability almost in the same position as the poa-tussock; but, as the dominant species of the montane tussock-grassland, the question of its palatability is a matter of far greater importance. Figs. 5 and 6 show that the fescue-tussocks as a whole were unaffected by the September overstocking. It was only in a few cases that the tussocks had been nibbled, while plants not extremely palatable, side by side with them, had been freely eaten. As with the poa-tussock, the fescue-tussock affords good feed after burning.

(3.) The blue-tussock (*Poa Colensoi*): The name *Poa Colensoi* is used collectively to include a number of closely related grasses which possess so many characters in common that, up to the present, taxonomic botanists have been content to apply this collective name to the whole group, and have made no attempt to separate it into the true-breeding varieties of which it is composed. Here it is only the plants of the Hanmer neighbourhood, including the tall blue-tussock, which are referred to. These may, of course, have a different palatability-value from one or other of the unnamed varieties making up the species. Judging from the former experiment, as also from many field observations, the blue-tussock seemed to be a grass of very low palatability, so that the question arose, Would it be eaten to any extent during overstocking, and might it be more palatable than either

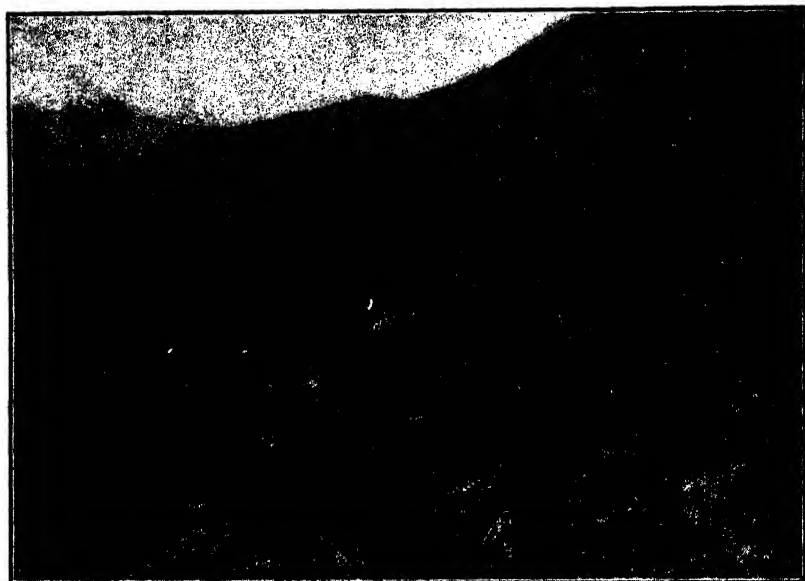


FIG. 5. GENERAL VIEW OF THE SOUTHERN TUSOCK-CLAD (*FESTUCA NOVAE-ZELANDIAE*) SLOPE OF CONICAL HILL.

Showing the grazed ground between the tussocks in the foreground and the dense growth further away.



FIG. 6. GROUND ON THE HILL OCCUPIED BY UNPALATABLE PLANTS.

In front, the swamp-lily (*Chrysobactron Hookeri*), showing black in the photograph; and behind, close growth of the fescue-tussock.

[Photos, W. D. Reid.]

the fescue-tussock or the poa-tussock? Fig. 8 shows distinctly that both these questions can be answered in the affirmative. When growing side by side on Conical Hill with either the fescue-tussock or the poa-tussock the blue-tussock was closely eaten. This happened again and again: it was no chance occurrence. The question now awaiting an answer is, What is the relative palatability of this grass? So far as present observations go it stands considerably lower than Yorkshire fog (*Holcus lanatus*), catsear (*Hypochoeris radicata*), sorrel (*Rumex Acetosella*), and hawksbeard (*Crepis capillaris*), and very much lower than meadow-grass (*Poa pratensis*) and cocksfoot (*Dactylis glomerata*).

(4.) Sweet vernal (*Anthoxanthum odoratum*): The former experiment showed that sweet vernal was also a grass of very low palatability. Fig. 2 clearly shows how greatly it was eaten during the September heavy grazing. From this a higher degree of palatability might be assumed for this grass than appears to be the case. Thus, sweet vernal is extremely abundant in the vicinity of Mount Peel (Canterbury), fields originally laid down in rye-grass having changed to sweet vernal; but during my visit to that locality during the first fortnight of last November the sweet vernal was apparently altogether neglected, fiorin (*Agrostis alba*) and catsear (*Hypochoeris radicata*) being selected in preference. Possibly sweet vernal may be of value during the winter and early spring, but for the rest of the year it can only be classed as a pasture-weed, occupying, as it does so frequently, ground capable of growing cocksfoot (*Dactylis glomerata*).

(5.) White clover (*Trifolium repens*): A surprising feature of the first experiment was the fact that white clover was not eaten at all. Also field observations during the months of January and February, 1919, supported this evidence. It becomes of extreme importance to ascertain accurately what position amongst pasture-plants must be accorded to a plant of generally believed high palatability. My observations, up to the present, have led to no finality. White clover was eaten freely during the September heavy grazing of Conical Hill. Also I have been able to record its being eaten on several occasions under ordinary grazing-conditions in different montane pastures of the South Island. On the other hand, meadow-grass, catsear, and even sorrel still appear to be of higher palatability than white clover.

(6.) Suckling-clover (*Trifolium dubium*): This, as pointed out in my former article regarding palatability, consists on Conical Hill "of insignificant plants." Evidently, then, it was not possible for me to accurately ascertain some weeks after the grazing had taken place to what degree it was eaten.

(7.) Other species which were eaten: The following species, the palatability of which was clearly demonstrated by the first experiment, were again freely eaten: Meadow-grass (*Poa pratensis*—see Fig. 4), cocksfoot (*Dactylis glomerata*), holy-grass (*Hierochloa redolens*), catsear (*Hypochoeris radicata*), hawksbeard (*Crepis capillaris*), Yorkshire fog (*Holcus lanatus*), tufted danthonia (*Danthonia semiannularis* var.), sorrel (*Rumex Acetosella*), broom (*Cytisus scoparius*).

The following, not mentioned for Conical Hill in the former article, were also eaten: Woodrush (*Luzula campestris* var.), *Carex breviculmis*, and red clover (*Trifolium medium*).

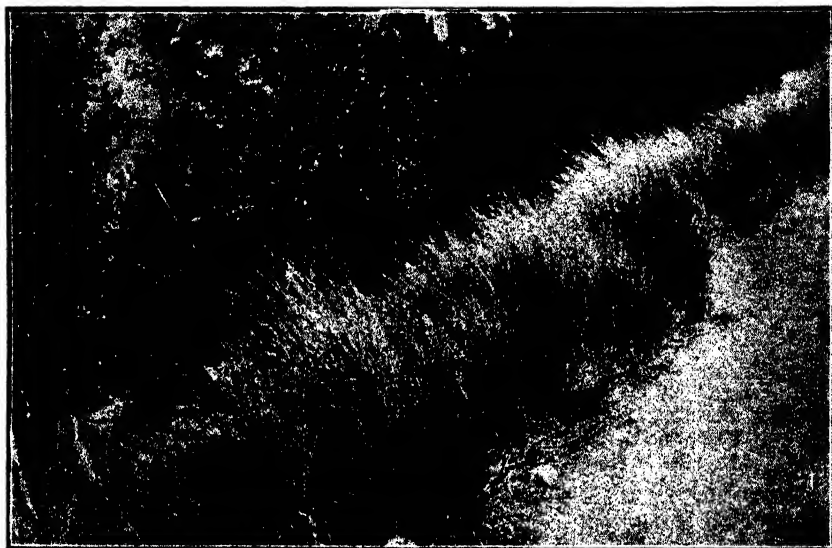


FIG. 7 POA-TUSOCK (*POA CAESPITOSA*) ON CONICAL HILL REMAINING UNEATEN AFTER THE HEAVY STOCKING.

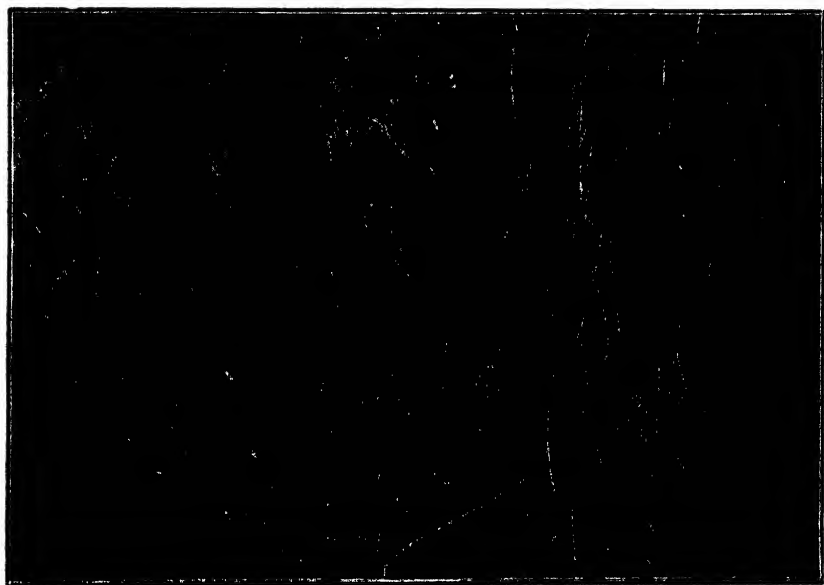


FIG. 8. BLUE-TUSOCK AND FESCUE-TUSOCK ON THE HILL.

On left, plant of blue-tussock which shows how strongly it had been eaten, though now with a good deal of young growth. On right, plant of fescue-tussock which had not been eaten at all.

[Photos, W. D. Reid.]

CONCLUSIONS.

1. The pasture-plants shown in my former article to be of high to medium palatability still keep their position.

2. The fescue-tussock (*Festuca novae-zelandiae*—the dominant species of montane tussock-grassland) and the poa-tussock (*Poa caespitosa*—the common tussock of the lowlands) are of such low palatability as to be virtually worthless except with regard to their young leaves which come after the tussocks are burned.

3. Sweet vernal (*Anthoxanthum odoratum*) is eaten freely in the spring, but in what sequence with regard to other palatable plants was not ascertained.

4. Blue-tussock (*Poa Colensoi*) is far more palatable than was expected from previous observations, and it is altogether a more palatable grass than either fescue-tussock or poa-tussock.

5. It follows from No. 4 that blue-tussock, as it provides food all the winter, might be a good grass to introduce into winter country where it is not already present.

It must be borne in mind that these conclusions are derived from observations made on an area which had been closely grazed during the early spring for five consecutive days by 645 crossbred hoggets.

FRUIT-TREES BLOSSOMING OUT OF SEASON.

THE most frequent cause of fruit-trees blossoming out of season is loss of foliage. This may be caused by the pear and plum leech, or by spraying with mixtures that are too strong, while sometimes plum-rust defoliates trees. In such cases the majority of the fruit-buds that should remain dormant till spring break into blossom. The result is the loss of the next season's crop, and nothing can be done. It is quite a common occurrence for a few precocious buds to break into flower. The cause for this not being easily explained. In such cases it is usually terminal buds that break, and no harm is done, as it does not affect the other parts of the tree. In many places it is quite common to get a second crop of fruit on Bon Chrétien pears, but the second lot being all on terminals no harm results. At the Arataki Horticultural Station, in Hawke's Bay, a Japanese plum known as Large Yellow several times remained evergreen. It produced a great show of blossoms in May and set the fruit, although most was lost from the effects of frost. However, only a portion of the buds broke, and the trees always produced a full crop at the proper season. Briefly put, premature blossoming does no harm when it is confined to twigs. Extensive blossoming will not occur unless the tree suffers a check, such as by loss of foliage, and when this occurs it results in loss of the next season's crop. Loss of foliage can usually be avoided by proper treatment of the pests that cause it. In any case no good will result from pruning before the usual time—namely, during winter while the trees are dormant.—W. H. Taylor, *Horticulturist*.

TESTING OF PUREBRED DAIRY COWS.

MUTUAL PEARL OF ROCK'S LATEST RECORD.

W. M. SINGLETON, Assistant Director of the Dairy Division.

AMONG the Friesians in the Register of Merit we now have three cows with records of 900 lb. of butterfat or over. These are Burkeyje Sylvia Posch, imported from Canada; Westmere Princess Pietertje, bred in New Zealand; and Mutual Pearl of Rock, imported from Wisconsin, U.S.A. Mutual Pearl's latest and best record, recently completed, gives her the third place in the breed in New Zealand as regards butterfat production.



MUTUAL PEARL OF ROCK.

Mutual Pearl of Rock has been on test four times, and each season she has produced remarkably well, although only two certificates of record have been granted. She failed to calve within the time prescribed after her first two tests. She again calved at the age of 5 years 330 days, and in 365 days was credited with a yield of 736·38 lb. of butterfat from 19,640·1 lb. of milk. Her next freshening was in twenty-four days after finishing this test, and she was again entered. This latest test raised her credit to 903·44 lb. of fat from 25,648·2 lb. of milk. Her four authenticated tests are as follows:—

Age at Start of Test.		Days in Milk.		Milk.	Butterfat.
Years	days.			lb.	lb.
3	187	..	..	15,677·0	523·58
4	282	..	..	19,568·8	650·62
5	330	..	..	19,640·1	736·38
7	11	..	..	25,648·2	903·44

The sire of Mutual Pearl of Rock is Mutual Piebe de Kol. No other United States bull has been so strongly represented in New Zealand by imported daughters. He is also represented by his son Mutual Piebe of Rock, who has a number of A.R.O. daughters in the United States and C.O.R. daughters in New Zealand. The daughters of Mutual Piebe de Kol that have won certificates of record in New Zealand, together with details of their production, are as follows:—

Name.	Age at Start of Test.	Fat required for Certificate.	Days in Milk.	Milk.	Fat.
	Y. dys.	lb.		lb.	lb.
Mutual Pearl of Rock ..	7 11	350.0	365	25,648.2	903.44
Martha Elgin Pauline II ..	5 330	350.0	365	19,640.1	736.38
Mutual Dulcina Vale. . .	7 2	350.0	365	17,707.4	604.94
Mutual Maggie of Rock ..	5 181	350.0	365	16,949.4	589.66
Heilo Johanna Lyons ..	3 295	306.5	289	16,242.1	545.41
Mutual Belle of Rock ..	2 244	264.9	365	13,599.5	487.24
Mutual Dulcina Vale. . .	4 217	335.2	324	13,554.2	469.28
Heilo's Torohunga No. 1 ..	3 185	295.5	342	12,882.1	433.68
Mutual Pontiac of Rock ..	4 229	336.4	278	13,031.1	429.67
	2 334	273.9	365	12,948.7	426.64
	1 304	240.5	365	11,210.2	358.96
	3 130	290.0	323	9,924.1	313.66

Unfortunately, some of the daughters of Mutual Piebe de Kol did not calve sufficiently early after test to qualify for a certificate of record. An indication of these productions, as authenticated by the Dairy Division, is given below, however, in order that the prepotency of Mutual Piebe de Kol may be further substantiated. Uncertificated records of this sire's daughters are the following:—

Name.	Age at Start of Test.	Fat required for Certificate.	Days in Milk.	Milk.	Fat.
	Y. dys.	lb.		lb.	lb.
Mutual Pearl of Rock ..	4 282	341.7	365	19,568.8	650.62
Mutual Ideal of Rock ..	4 229	336.4	365	20,828.2	642.77
Mutual Dulcina Vale. . .	7 270	350.0	365	17,486.3	550.37
Mutual Pearl of Rock ..	3 187	295.7	365	15,677.0	523.58
Mutual Fannie Vale Piebe ..	3 163	293.3	348	12,666.9	465.31
Martha Elgin Pauline II ..	3 186	295.6	365	12,251.7	432.66
Mutual Fannie Vale Piebe ..	4 272	340.7	313	11,679.1	425.60

It will have been seen that Mutual Pearl of Rock "came back" with her yield season after season. Another good example of this trait in the daughters of Mutual Piebe de Kol is that of Dominion Mutual Mercedes of Rock, imported by the New Zealand Department of Agriculture. For her first four seasons, under ordinary good herd conditions and with twice-a-day milking, her credits were,—

Age at Start of Test.	Fat required for Certificate.	Days in Milk.	Milk.	Fat.
Years days.	lb.		lb.	lb.
2 10 ..	241.5	362	11,604.30	373.06
3 6 ..	277.6	336	12,047.25	414.33
3 348 ..	311.8	356	12,628.75	427.19
5 27 ..	350.0	332	14,649.00	529.76

Mutual Pearl of Rock was imported and tested by Mr. W. Barton, of Featherston. With the exception of two animals all the daughters of Mutual Piebe de Kol referred to above were owned and tested by Mr. Barton. We consider that the importation of this strain in such large numbers has been of direct benefit to New Zealand purebred Friesians and to New Zealand dairy stock in general. The influence of this family will be continued, as representatives are to be found in the sires now being used in a number of Friesian herds, including among others those of P. McNaughton, Morrinsville; Dickie and Clegg, Wainui-omata; the Boys' Training-farm, Levin; J. C. N. Grigg, Longbeach; and the Central Development Farm, Werarua.

MILK AND CREAM FOR FACTORY SUPPLY.

THE PRODUCTION OF SOUND RAW MATERIAL.

(Continued.)

G. M. VALENTINE, Dairy Instructor, Auckland.

THE MILKING-MACHINE.

THEORETICALLY, machine-drawn milk should be purer than that drawn by hand, but it is a matter of common experience that where there is an increase in the number of machines in use in a district the quality of the milk-supply shows deterioration. The fact that some machine-users can supply milk and cream of high quality shows that this deterioration is either the result of neglect or of ignorance on the part of the others as to the proper means to adopt to keep the machines thoroughly clean. A good deal of this ignorance is the direct result of competition among salesmen who, in their anxiety to make sales, minimize the amount of care necessary to keep the machine thoroughly clean. The invention and general adoption of the releaser system has increased the cleaning difficulty, and it is doubtful whether there has been any actual gain to the dairy industry as a result of its use. Practically the only saving has been in the actual work of milking. In the case of a small herd this is balanced by the extra labour entailed in washing the releaser after milking is finished, if the work is done thoroughly. There is little doubt that the releaser has resulted in a general drop in the quality of milk and cream, which has resulted in expensive pasteurizing plants being required at the factories to deal with defects in the raw material.

The proper erection of the milking plant in the first instance will minimize the labour entailed in cleaning, and attention is directed to the following points: All piping, whether for the conveyance of milk or attached to the air-system, should be erected in lengths not exceeding 6 ft., and should be provided with unions so that they can be taken down for cleaning. Drawn-brass piping is compulsory for milk-pipes, and it is to be preferred for air-pipes, as it is much more

easily kept clean. Several makers are now erecting their machines in this manner.

Regarding the air-pipes: have as few angles as possible, and if they cannot be avoided put in crosses and plugs instead of elbows or bends, as it is then an easy matter to get a brush into the pipes. A tap for flushing the air-system should be provided at the end farthest from the vacuum-pump. Should milk get into these pipes at any time through a split inflation, or through the air-tube being connected to the milk-pipe on the claw by mistake, it can be at once flushed out with cold water followed by boiling water and soda.

The vacuum-tank should be erected outside in the open air where there is a concrete floor under it, so that it can be washed out and emptied with the least trouble. It should be placed so that it can be reached from the floor without climbing up a ladder, and the lid should be big enough to allow of every part of the tank being seen and reached with a brush without difficulty.

The overhead milk-pipe should be erected with a drop of about 1 in. in 60 from the far end of the machine to the releaser, and must be perfectly straight so that the milk and wash-water will not lie in the pipe. For this reason and others already given do not have the releaser-inlet higher than the level of the overhead pipe. Have the releaser erected so that one can easily see into it and reach every part with a brush. If the shed is too low the roof should be raised.

At least two tubs are necessary for the proper handling of milking-machines, one in which to wash them and the other for holding the parts between milkings.

WATER-HEATING APPLIANCES.

For heating water for washing purposes there is nothing better than an ordinary washing-copper, because it actually boils the water. No other heating arrangement brings the water up to boiling-point (212° F.) and holds it there. The whole of the separator parts can be dipped right into it, and come out thoroughly scalded and in a few moments are dry. The same can be done with the releaser, and for scalding out the milking-machine it provides the hottest water that can be got, while once a week the milk-tubes can be put into it and boiled.

Where steam is available it should be arranged so that the pipes can be connected direct on to the milk and air pipes of the machine, as it is difficult to get water which is heated in a tub above 190° by blowing steam into it.

Water heated by any of the various arrangements attached to the engine-exhaust, copper, or cooling-tank is quite useless for scalding dairy utensils. In fact, these contrivances are responsible for quite a large proportion of the faulty milk and cream received at our factories. Having purchased one, the dairyman considers himself equipped with everything necessary for heating water to keep his machine clean. The water is quite hot enough for ordinary washing up, but by the time that is finished the supply has run out, and consequently the machine never gets thoroughly scalded. The result is a yellow deposit on the inside of the milk tubes and pipes, and a complaint of milking-machine flavour in the milk or cream. Cases can be quoted where a change from exhaust-heated water to boiling water for scalding the machine after

it had been thoroughly washed has got rid of this flavour in a supplier's cream, the grade rising from second grade to 92 points or over. Oil-engine heaters are also liable to give trouble on account of the danger from leaks, and an oily flavour in cream has frequently been traced to this cause.

MILKING-SHED CONDITIONS AND PRACTICE.

The erection of an up-to-date milking-shed provided with every convenience does not necessarily ensure a high quality of milk or cream. It will certainly make it much easier to produce a good quality, but unless the shed and appointments are kept thoroughly clean no improvement will result. Many sheds are allowed to get into such a state that the milk produced is not so good as that produced under the most primitive conditions.

The atmosphere surrounding a dirty milking-shed is laden with germs which find in milk a congenial breeding-ground, providing the food and temperature best suited to their development. From the growth of these germs in the milk come the "unclean" flavours, even though the utensils may be above reproach. The importance of this matter of bad smells is not grasped by many dairymen. Recently a case of unclean flavour in cream was found to be due to the supplier's habit of throwing the wash-water a few feet from the door of the dairy. Unclean flavour has also been traced to the practice of standing the can of cream beside an opening in the wall through which the drainage escaped, the draught coming in through this opening after passing over the dirty drain being the cause. As the bad flavour disappeared after the cream was shifted to another position, conclusive evidence was afforded.

In a machine-milking shed an unclean atmosphere is an even greater danger. The air in a milking-machine is only as pure as the source from which it is drawn. Every milking-machine has on some part of the teat-cup or claw an air-inlet to ease the suction on the teat. This air, together with the milk drawn from the udder, is carried along through the milk-pipe to the releaser, with the result that the smell of the shed is absorbed by the milk. The surging of this air and milk can be seen through the sight-glasses usually inserted in the milk-tubes, and the aeration of the milk observed.

Again, in order to maintain the partial vacuum of 15 in. at which most milking-machines work, a safety-valve is provided on some part of the air-system. Through this valve a certain quantity of air is drawn at each stroke of the pump. Obviously if this air is foul the whole system must be the same. Further, in a shed the floor of which is unwashed, manure in the form of fine dust raised by the movements of the cows is drawn directly into the milk.

Milk from a newly calved cow should not be used until the fifth day after calving at the earliest, but in many cases a good deal longer should be allowed to elapse. It depends entirely on the state of the milk. Milk from a cow that has not properly cleansed should never be used, as it would cause a flavour resembling putrid meat. Cowy flavour is usually the result of overheating cows by racing them with dogs. This will also tend to reduce the test, as a nervous cow will not secrete so much fat in the milk when highly excited.

Generally speaking, a better quality of milk is received from a hand-milking shed than from machines. Where this is not so it is usually the result of the neglect of the simplest rules of cleanliness. Common-sense will tell the average milker that an udder which has been dragged through the mud requires washing and drying before starting to milk. In dry weather and in clean surroundings a rub with a dry cloth may be quite sufficient, but the habit of washing the teats before each milking is a good one to get into. Cleanliness in this washing is quite as necessary, however, as in any other part of the dairy-work. To rinse the teats with water from a dirty bucket, using a sour odorous rag which is never washed, is worse than useless; yet this is the practice in many sheds where they would never dream of starting milking without going through the form of washing the udders. These buckets and cloths must receive their share of attention.

The number of sheds in which proper conveniences are provided for the milkers to wash their hands is comparatively small, and in some cases such washing is never done. This neglect and the practice of wearing the dirtiest clothes in the shed are two of the most common sources of milk-infection, and also one of the causes of the spread of disease in the herd. To the average clean person it is second nature to be as careful over milking as in the handling of any other food, but the shed where these points are neglected is easily picked out by the dirty state of the leg-ropes, bail-pins, gate-fastenings, &c.

It is a good practice in machine milking to draw some cold water through the milk-pipes before starting. This will damp the pipes, which will be much easier to wash afterwards.

MILK STRAINING AND STRAINERS.

Unless the strainer is kept clean it is better not to use one at all. A good strainer will take out the sediment in the milk, but will not remove the germs and fluid which do most harm. The obvious thing to do, then, is to keep the dirt as much as possible from getting into the milk. Too often the strainer is a cause of infection, as a result of the state in which it is kept. A clean cloth makes a good strainer, but it must be washed and scalded every day. If this is not done it will soon become coated with a deposit of yellow stale milk, and will do more harm than good.

It is impossible to wash a wire strainer thoroughly with a cloth. A deposit of stale milk will usually be found just where the gauze and the tin are soldered, and quite often the same deposit shows in the corners. The circular strainer usually sold in country stores, having a piece of gauze in the centre and a rim soldered on to the bottom, is a survival of the pan-skimming days. At the junction of the rim with the body there is a crevice which is very hard to clean, and is frequently found to be full of sour, stale milk. Dairymen are advised to get the better class of strainers now made by dairy tinsmiths. No holding-frame is required for the larger sizes, as they hook on to the side of the vat or can with clips. The corners and seams are well floated over with solder, and are easily kept clean. (See Figs. 1 and 2.)

An improved circular pattern of strainer, suitable for use with the ordinary round separator milk-tank, is made in one piece of drawn tinned steel without seam. The straining-medium consists of one

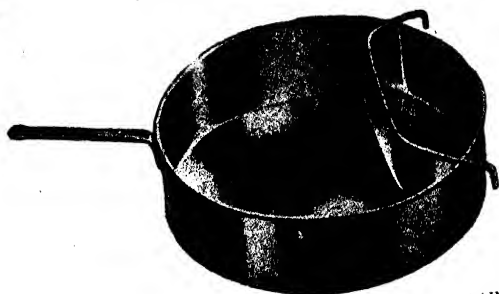


FIG. 1. AN IMPROVED TYPE OF MILK-STRAINER.

The milk is twice strained, with no clogging of the gauze. The sediment falls to the bottom of the strainer—not on the gauze, to be washed through.

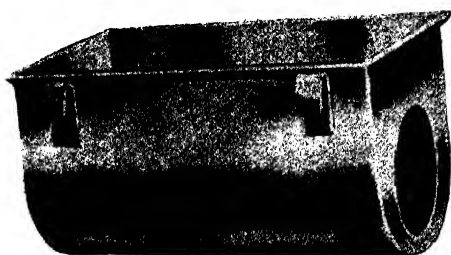


FIG. 2. ANOTHER GOOD TYPE OF STRAINER.

Note clips for hanging on side of milk-receiver (also in Fig. 1).

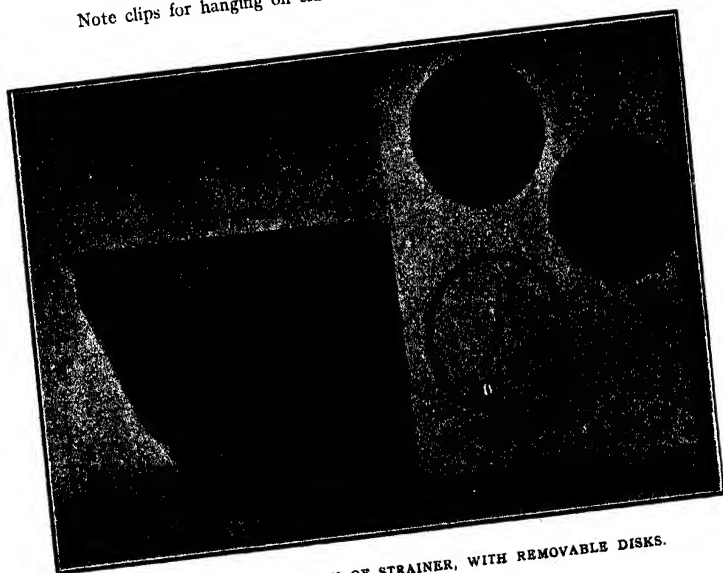


FIG. 3. CIRCULAR PATTERN OF STRAINER, WITH REMOVABLE DISKS.

piece of perforated tin and one piece of fine gauze (the latter on top), held in position by a spring clip. As the disks are removable they are easily kept clean. New disks can be put in at any time, thus doing away with the difficulty of getting them soldered. (See Fig. 3.)

COOLING MILK.

The care of milk for direct delivery to a factory is a simple matter, provided ordinary cleanliness has been observed in its production. The milk should be cooled immediately it is drawn by passing it over a cooler of sufficient size to reduce the temperature to within a few degrees of that of the water available. The size of cooler required will depend on the volume of milk and the temperature of the cooling-water. If cool water direct from a well is available a small cooler will do better work than a larger one when comparatively warm creek-water has to be used. Water which has been pumped in the morning and has stood in the sun all day is practically useless.

Under average conditions a cooler 12 in. wide by 28 in. deep will be sufficient to cool the milk from forty cows. In the case of machine milking an 18 in. by 28 in. cooler will probably be necessary. When buying a cooler it is always best to get one on the big side, as a large cooler will do better work than a small one if the supply of water is limited or if the water is not very cold. Even if the supply of water should fail, milk will be improved by running it over a cooler, provided the surrounding atmosphere is pure. Spread the night's milk over the whole of the cans in use, by means of a tray having a hole for each can, but do not mix morning's and night's milk together.

Stir frequently with a metal plunger (Fig. 4), but do not use a wooden stirrer. On a farm where no steam is available it is almost impossible to keep a wooden stirrer clean and sweet.

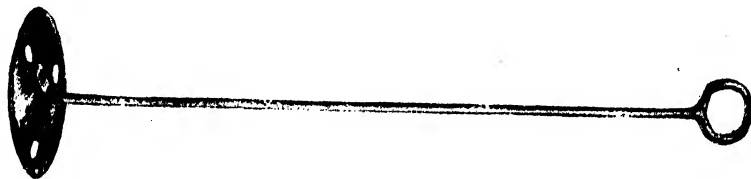


FIG. 4. METAL PLUNGER FOR STIRRING MILK OR CREAM.

Do not think that the morning's milk does not require cooling because it is not held long on the farm. Cooling is not recommended solely for the reason that it keeps the milk from going sour, but also as a means of getting rid of animal odours and feed flavours. It is thus most beneficial when done immediately the milk is drawn.

The delivery of first-quality milk at the factory is a business proposition for the supplier. The condition of the milk has a direct influence on the test, as proper care in cooling and stirring will prevent the cream from rising. A better quality and a higher yield of both butter and cheese can also be made from milk which has been properly cared for.

TREATMENT OF CANS.

Cans when received back from the factory require to be washed and scalded. Even if thoroughly washed and scalded at the factory

(which is seldom) it is necessary to repeat the operation after the cans have been closed up for some hours.

Metallic flavour in both milk and cream is caused by rusty cans. This is due to the action of the acid on the steel of which the cans are made. This action is very rapid in milk-cans in which whey is brought home from the factory. Where cream is held for two days on the farm before delivery this flavour becomes very pronounced. Enamelled buckets, though excellent for holding cream while new, are easily chipped, and once the iron is exposed do not last very long. Well-tinned milking-buckets are quite as good, and in most hands last a good deal longer.

Suppliers having rusty cans should return them to the makers and have them retinned. The cost will depend on the condition of the can and the distance from the works. A minimum freight can be secured by sending them through the factory, which can arrange for a number to be sent together. Ten-gallon cream-cans in a very bad state have been done at a cost of 16s. each (not including freight), and as the dents were taken out at the same time, floats repaired, and labels resoldered, they were practically made over again. Compared with the cost of the same can when new (about 60s.) it is money well spent. Cases can be quoted where a defect in cream disappeared entirely after the cans were retinned.

THE CARE OF CREAM.

The keeping-quality of cream depends to a great extent upon the handling of the separator. Cream which has an even, smooth texture, and contains from 40 to 45 per cent. of fat, is the best for all purposes, though a 50-per-cent. cream is even better from the keeping point of view. As, however, the conditions have to be exceptionally good for most separators to do clean skimming when delivering a 50-per-cent. cream, it is not advisable to skim so thick.

Most of the flavours complained of in cream develop in the curd which it contains, consequently the likelihood of such flavours is less in cream containing a low percentage of curd. Many suppliers argue that it does not pay to send in rich cream, as the return from the factory is not so good for such quality. This was correct in the days when a pipette was used to measure the samples into the test-bottles, for 9 cubic centimeters of rich cream weighed less than 9 cubic centimeters of thin cream. But this is not the case with present-day testing, as all samples are weighed. Any supplier wishing to satisfy himself on this point can do so by altering his separator from day to day to skim cream of varying thickness, and having the skim-milk tested after each alteration. If there is no great loss of fat in the skim-milk when skimming rich cream it follows that the factory will show an equal return, as the fat originally contained in the milk must be in either the cream or the skim-milk.

For many other reasons thin cream is inferior to rich cream to the supplier and the buttermaker, and is a cause of loss to both. The feeding-value of skim-milk for use on the farm is anything from 1d. upward per gallon, so that in sending it away to the factory in his cream the supplier is robbing himself.

If the cream is thin and sour, testing, say, 25 per cent. of fat, it is a very difficult matter to get a correct sample. The error may be either way, but is more likely to be against the supplier, consequently it is unsatisfactory to both parties. This thin cream will also give trouble by blocking up the strainers; it is very liable to give a scorched flavour to the butter through burning in the pasteurizer, is more expensive to handle on account of its bulk, and the loss of fat in the buttermilk is greater.

COOLING AND SHELTER.

The importance of efficient cooling as it leaves the separator is second only to cleanliness in the production of high-grade cream. As in the case of milk, the reason for cooling cream is not solely to keep it from going sour. Practically all cream which is delivered every other day is sour when received at the factory, but the percentage of acidity will vary according to the treatment it has received both before and after skimming. Acid, however, is one of the minor defects found in cream, providing it is clean-flavoured. Putrefactive germs, which may find their way into cream even in the cleanest dairy, will be checked by efficient cooling, and strong animal-odours will be removed; but cooling will not prevent the growth of germs which result from dirty milking-machines, separators, &c. Those are germs which only the pasteurizer will kill, and the flavours which they produce very frequently remain after pasteurizing. Further, cooling will not do any good if the surrounding atmosphere is impure.

As a means of getting rid of feed-flavour cooling is not sufficiently appreciated, and it is difficult to convey anything like the importance of this matter to any one who has not had a practical demonstration of the difference between cooled and uncooled cream. Such feed-flavours as result from cows eating the strong growth of pasture in the spring—trefoil, Lotus major, clovers, sweet vernal, lucerne, &c.—can be almost entirely eliminated by cooling, or, at least, so minimized as to be hardly noticeable. Therefore the excuse that these are the predominant grasses on the farm can hardly be accepted. Flavours such as those of garlic, pennyroyal, and other weeds of a similar nature will certainly be reduced, but cannot be got rid of altogether. This is also true regarding the flavour caused by the cows drinking swampy impure water or eating weeds growing in land of that nature.

To be effective the cooling must be done as the cream leaves the separator, and to get the best results the cream must be exposed to the action of the water and air by being spread over the cooler in a thin film. The thinner the layer of cream and the colder the water the better will the results be. Difficulty in getting the cream to spread over the whole surface of the cooler is usually the result of bad washing. If the cooler is greasy, through not having been thoroughly scalded, the cream will trickle over the cooling-surface in small streams instead of spreading.

For a separator up to 50 gallons per hour the flat horizontal cooler measuring 30 in. by 3½ in. by 1½ in., and made by the various dairy-supply firms at a cost of about £1, is suitable. This cooler (Fig. 5) can be very easily arranged to hang under the cream-spout at the receiving end and rest on the cream-can at the open or delivery end,

with a fall of not more than $\frac{1}{2}$ in. to the cream-can. The cream will then pass very slowly over the cooling-surface. Attach the hose at the lower end of the cooler, so that the water is running from the lower to the higher end—that is, in the opposite direction to the cream. By this means the water-jacket is kept full and the cold water is meeting the cold cream, while the partially warmed water is meeting the hot cream. This is the principle upon which the efficiency of all coolers depends.



FIG. 5. HORIZONTAL TYPE OF COOLER FOR HAND SEPARATOR.

For large separators a small circular cooler (Fig. 6) measuring about $7\frac{1}{2}$ in. wide by 12 in. high will be required. A small stand is necessary for this style of cooler, and this can be easily made by fitting a piece of pipe into the concrete floor. Cut a piece of board large enough to take the cooler, and nail a piece of 3 in. by 2 in. across it. Bore a hole in the 3 in. by 2 in. and screw it on to the top of the pipe. A hole through the board for the overflow hose will complete a cheap and easily washed stand. Put the hose on the bottom and outside connection on this cooler also.

If no water is laid on to the separator-room an oil-drum with a tap soldered into it can be used. Place the drum on a bracket at a

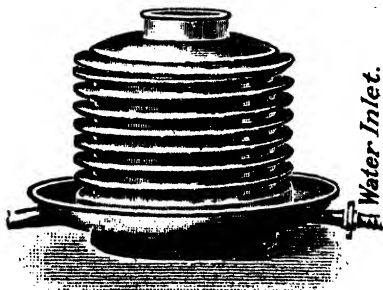


FIG. 6. SMALL CIRCULAR COOLER FOR LARGE SEPARATOR.

point where the bottom of the drum is a little higher than the highest part of the cooler, and connect the hose from the tap to the water-inlet in the cooler. One of the taps usually sold for filling kerosene-lamps, with cutter for perforating the tin and rubber washer to make the joint, if screwed into a benzine-tin, makes a cheap water-can. It requires a short length of pipe soldered into the outlet to connect the hose. The fact that a large supply of water is not available is no excuse for not cooling cream. More water is required for washing up than will be necessary to cool the cream, and as the same water can be used for washing up it makes no difference to the amount used.

If comparatively warm tank or creek water is the best that can be got it can be cooled very considerably between milkings by placing some in a can in the draught caused by the ventilation, which latter should be provided in all separator-rooms. If a wet sack is wrapped round the can the water will cool even better, especially in hot districts where cream-cooling is most necessary.

The same results are not attained by placing the can of cream in cold water as by passing it over a cooler. The bulk is too great to allow the heat and odours to escape, even if thoroughly stirred, which is not often done. Place the cream in cold water after it has been cooled, and stir frequently with a 6 in. metal plunger. A wooden stirrer is, if anything, worse for cream than for milk, as owing to the greasy nature of the cream it is harder to keep clean.

A very efficient shelter for cream may be built as follows: Construct a square frame with sufficient floor-space and height to hold all the cans in use, allowing enough head-room to get at the cans for stirring. Make the floor of open battens about 2 ft. from the ground. Have a tin dish made about 6 in. deep to fit into the top of the frame. No roof is required. Tack strong scrim round three sides of the frame, having the top edge long enough to hang over into the dish; tack another piece of scrim along the top on the fourth side of the frame; sew or tack a round stick on to the bottom edge of the scrim, so that the front covering can be rolled up and form a door. Fill the dish with water, and damp the scrim all round the top edge to give the water a start, and it will siphon down the sides and keep the air in the shelter cool in the hottest weather. The temperature of the water placed in the dish does not matter. Cream treated in this way has been delivered to the factory practically sweet at two days old. The more exposed the position in which the stand is placed the better will be the result.

Even in the best-conducted dairy it is advisable to remove the cream to a stand, but if no water is used as described it should be built in some shady spot—say, under a tree. Small quantities can be hung up in a tree if a clean piece of buttercloth is tied over the can, as there is usually a cool draught in such a place.

Where cream has to be left on the roadside to be picked up by a wagon some means of protecting it from the sun should be provided. In some cases it is brought out early in the afternoon of the day before it is picked up, and stands for some hours in the hot sun. Cream treated in this way will develop an oily, metallic flavour.

Lids should never be put tight on cream-cans until about to send them away, as they will prevent the escape of any gas which develops. Stir each skimming immediately after separating, in order to break down the froth, and as often afterwards as possible.

MIXING.

Even when thoroughly cooled, it is not advisable to mix the cream until it is being sent away to the factory, or, at least, until the next milking. Where the cream is not cooled it is disastrous to mix, as the mixing of the hot and cold cream will keep the temperature up to the point at which the germs multiply rapidly, and thus develop all

the worst flavours. This is one of the causes of "Maori bug" flavour in cream—one of the worst to deal with.

It is a good plan to have a bucket or can for each skimming, and keep them separate until just before sending away. Do not use benzine-tins for carrying away milk or to hold cream in. It is possible to make a good bucket out of a benzine-tin if the bottom seam and the top edge are floated over with solder, but unless this is done (and it seldom is) it is impossible to get the sour milk out of these two places.

Dirty tins and barrels in the separator-room to catch the skim-milk are a frequent source of infection. The atmosphere of the whole room is polluted with the smell, which is absorbed by the cream. This flavour is common on most factory platforms, and can be easily distinguished, as it resembles nothing so much as the sour, yeasty smell of the barrel from which it originates. If left long enough this class of cream will develop fermentation.

VENTILATION OF SEPARATOR-ROOM.

The necessity for a pure atmosphere in the separator-room cannot be too strongly urged. It can only be maintained by scrupulous cleanliness and proper arrangements for ventilation. On opening the door one is frequently met by a combination of odours in which sour milk, separator-oil, dampness, &c., are all present. This may not be noticed by the owner, as he is used to it. The cause may be splashes of milk on the walls, benches on which cream has been spilt, or a separator-block saturated with oil. Cream kept in such an atmosphere cannot but be poor. The remedy is boiling water and limewash. Rooms which have been formerly used for pan-skimming dairies should have a good coat of limewash to get rid of the stale smell which frequently pervades them. Rooms in old buildings usually give a flavour of decayed wood to the cream.

Ventilation should be provided in the separator-room by making an opening on a level with the floor on one side of the room, and near the top of the wall on the opposite side. On a hot day the heat of the sun on the roof will cause a circulation of air through these openings, and the draught at the bottom will dry the floor and keep the place sweet, providing everything in the room is perfectly clean.

In many cases where the separator-room is built with vertical boards without battens the owner argues that there is plenty of ventilation—too much, in fact, in cold wintry weather. The time when ventilation is most necessary is in warm sultry weather when the air is heavy, and to create this air-circulation a proper arrangement of ventilators is necessary.

A coat of limewash once a year will greatly help to keep the separator-room fresh and sweet. This can be put on with a spray-pump, which is a much quicker method of doing it than by hand.

It is a mistake to build a separator-room too big. The unoccupied space is a temptation, and results in all manner of miscellaneous articles being stored in it to the detriment of the cream. The practice of placing the separator in one end of the milking-shed is, happily, not common, and should not be allowed under any circumstances.

(To be continued.)

THE GEOLOGY OF LIMESTONE.

Extract from "THE LIMESTONE AND PHOSPHATE RESOURCES OF NEW ZEALAND": Geological Survey Bulletin No. 22, by P. G. MORGAN, Director, assisted by officers of the Survey.

LIMESTONE is a rock that during some bygone period of the earth's history was, as a rule, formed in beds or layers under a sheet of water, in most cases salt, but in some fresh. With the exceptions to this general statement the reader need not at present trouble himself. As originally formed most deposits of limestone extend over large and perhaps immense areas, but all, of course, must have had limits. Subsequent happenings have in nearly all cases reduced those limits, and not infrequently the reduction, especially for practical purposes, has been enormous.

In order that the reader may clearly understand what the original limits of a bed of limestone were he must ascertain the conditions accompanying the formation of the deposit—that is, its mode of origin; and if he would know what the present limits are he must not only explore the outcrops, but must study the changes that have taken place since the deposit was formed—that is, he must dip rather deeply into the science of geology.

By proper field studies it will be found that some calcareous deposits—for example, those of concretionary origin, those formed by precipitation from springs (travertine), and those formed in fresh-water lakes—have comparatively small extent. Again, many limestone beds vary enormously in thickness and in quality from place to place. Often an originally large deposit, owing to the action of wind and weather, running water, ice, &c., becomes reduced to a small body. Especially is this the case when the limestone has been raised to an elevated position by forces working within the earth's crust, so that the eroding and dissolving agents mentioned above have free scope for action.

One of the most important facts in connection with carbonate of lime is that under certain conditions it is soluble in water, whilst under other conditions water containing carbonate of lime in solution deposits it as a solid substance (stalactite, stalagmite, travertine, &c.). Water is capable not only of dissolving many solids, but also of dissolving or absorbing appreciable quantities of all gases. Cold water in contact with carbon dioxide can dissolve its own bulk or more of the gas, and then becomes what may be called carbonated water. The solution is really a weak acid (the true carbonic acid), and, as such, slowly dissolves carbonate of lime and various other substances. If boiled it parts with its carbon dioxide, and the same thing happens to a considerable extent when the carbonated water is exposed to air. It is not the function of this bulletin to explain the physical laws regulating the solution of gases by liquids, and therefore the solution of carbon dioxide by water, but it is as well to say that scientifically exact statements cannot easily be made without diving into the science of physics. What has to be said here is that rain-water contains a little carbon dioxide derived from the atmosphere, and by means of this contained carbon dioxide it

becomes capable of acting much more energetically upon limestone than perfectly pure water (which, it should be remembered, does dissolve limestone to a small extent). In its passage through the soil rain-water may absorb more carbon dioxide, produced by decaying vegetation, and thus become still more capable of dissolving carbonate of lime and many other minerals. Such comparatively highly carbonated water may percolate through limestone, slowly dissolving the rock in its journey. In the course of time great passages and caverns are thus formed in the limestone. Later the conditions are changed somewhat, and water dripping through the roofs of the caverns deposits part of its dissolved carbonate of lime in the form of stalactites pendent from the roofs, and the greater part of the remainder on the floors in the form of stalagmite. In this manner are formed the beautiful limestone caves found in many parts of the world. The explanation of stalactites and stalagmites generally given is twofold. In the first place, the lime-charged water holds more carbon dioxide in solution than it can normally take up from air. Coming into contact with air it gives up the excess of carbon dioxide, and then is compelled to deposit a corresponding amount of carbonate of lime hitherto held in solution as the double carbonate $\text{CaCO}_3 \cdot \text{H}_2\text{CO}_3$, otherwise represented as $\text{CaH}_2\text{C}_2\text{O}_6$. Secondly, some of the water evaporates, and with it some of the carbon dioxide goes. This causes precipitation of part of the dissolved carbonate of lime. It is possible that in some cases bacteria play a part in the formation of stalactites and stalagmites.

Large as may be the amount of carbonate of lime dissolved by carbonated water from limestone, a still larger amount is dissolved by percolating water from other classes of rock. Ultimately the greater part of this dissolved lime is carried by rivers to the sea, which is, indeed, the great storehouse from which nearly all limestone deposits are derived. From sea-water countless organisms, of which the most familiar are shell-fish and corals, abstract carbonate of lime in order to form their hard parts.* When these organisms die, their calcareous remains may be partly redissolved by the sea-water, but for the most part they collect on sea-beaches and on the sea-bottom, forming calcium-carbonate deposits of varying degrees of purity, which in time consolidate to hard limestone. As time goes on the calcareous deposits may be covered by beds of sand, mud, or other material. Then may come far-reaching geological changes: great earth-movements take place, the bed of the ocean is upheaved and becomes dry land. The originally horizontal or nearly horizontal strata may remain horizontal, but in many cases are tilted, broken by faults, and bent or crumpled into folds. In places the land may be so greatly elevated as to form mountain-ranges, on the top of which may be found rocks containing shells and other fossils, indicating that the strata once formed part of the ocean-bed. Unless the climatic conditions are altogether inhospitable vegetation quickly appears, forming a green protective coat on the newly born land. Running water and other erosive agents at once get to work, doing their best to destroy the work of the elevatory forces, and in course of time carve deep valleys. The limestone beds, which at first were probably hidden by overlying deposits, are exposed and dissected by the streams, which

* This statement has been disputed. Some authorities consider that dissolved calcium sulphate is the source of the lime used by sea-animals in building their solid parts. See A. Geikie's "Text-book of Geology," 4th ed., Vol. I, 1903, p. 613.

if small will follow underground channels in the limestone, but if large will soon cut valleys through it. An important practical point is the manner in which surface water and small streams disappear underground in limestone country owing to the formation of sinkholes and subterranean watercourses.

Emphasis must be given to the facts that all important limestone deposits have been formed in the sea as horizontal sheet-like layers of great lateral extent, and that subsequently they have been elevated, and in many cases contorted and broken. Denuding agencies have exposed beds of limestone originally hidden under other deposits, in places over wide areas, in places to a small extent only. In many districts the whole or the greater part of a limestone deposit has been removed by denudation.

ORIGIN OF LIMESTONE.

Most limestone is of organic origin—that is, derived from the remains of calcareous animals or plants; some, however, is of chemical origin—that is, precipitated from solution; and some may be regarded as mechanically formed—that is, it is derived from the waste of a pre-existing calcareous deposit. Considered with respect to their origin or mode of formation, limestone deposits may therefore be divided into three classes, which will be described in the order of increasing importance.

I. *Mechanically formed Limestone.*—No limestone can be correctly termed a mechanically formed rock except with regard to its mode of accumulation. Thus limestone debris may collect at the foot of a cliff; shell-banks may be formed on a beach by the action of the waves; finely broken shells, corals, &c., may be blown inland by the wind and form calcareous sandhills and ridges. Some of the so-called soft-limestone deposits of New Zealand belong to this class. They seem to be weathered accumulations of limestone debris.

II. *Chemically formed Limestone.*—Carbonate of lime may possibly be precipitated from solution in shallow parts of the sea, owing to the heating or partial evaporation of the sea-water. Such deposits, however, if they occur, are of little importance. Even in the cases where arms of the sea have been totally cut off from it, and evaporated to dryness, no great bed of limestone can result. It is thought, however, that some large deposits of chalky limestone are partly of chemical origin. The theory is that in the deeper parts of a sea cut off from the general oceanic circulation chemical changes (assisted by bacteria) would cause the precipitation of carbonate of lime from sea-water.

The deposits of travertine, calcareous tufa, or calcareous sinter formed by precipitation of carbonate of lime from the water of some springs and a few rivers have already been mentioned. Calcareous sinter must be distinguished from the siliceous sinter deposited by most hot springs, a material which is valueless for agricultural purposes. There is reason to believe that much travertine has been formed through the action of fresh-water algæ, and thus is of organic and not chemical formation.

Oolitic limestone, or oolite—that is, limestone formed of small spherical grains of carbonate of lime with a concentric structure—is generally classed as of chemical origin, but it is now known that minute

algæ play an important part in abstracting the carbonate of lime from sea-water, and therefore oolitic limestone is more correctly considered to be of organic origin. Pisolitic limestone, composed of large grains approaching peas in size, is otherwise similar to oolite.

At Kotuku, near Greymouth, several bores drilled in search of oil discharge in geyser-like fashion salt water highly charged with carbon dioxide and dissolved carbonate of lime. The greater part of the carbon dioxide at once escapes, and abundant carbonate of lime is in consequence deposited wherever the water touches any solid object. As the water flows away it forms numerous little balls of carbonate of lime, in size and appearance resembling marbles. Here, at least, we have chemically formed "pisolite."

Under the head of chemically formed limestone are to be included stalactite, stalagmite, and calcareous concretions of all kinds. Veins of calcite such as are common in the rocks of many districts—for example, the Waihi goldfield—may be classed here.

Marble, or limestone that has been more or less recrystallized and otherwise altered, is sometimes classed as a chemically formed rock. For most purposes it is better to go farther back in its history and consider the mode of formation of the original limestone.

III. *Organically formed Limestone*.—This, the most important class of limestone, includes all limestones formed by the action of plants or animals. The chief of these are: Ordinary limestone, formed by the accumulation of calcareous material secreted by living organisms of many kinds; coral limestone, in which the main part of the material is composed of the hard parts of corals; polyzoan limestone, similar to coral limestone, but composed mainly of the remains of Polyzoa (Bryozoa); chalk, composed mainly of the remains of the minute organisms known as Foraminifera; alga limestone, formed mainly of the remains of calcareous algæ; and lake-marl, formed in lakes by the accumulation of the remains of fresh-water algæ, shells, and other organisms.

The following part analysis* of a calcareous seaweed or alga (*Iania novæ-zelandiæ*) is of interest, and is therefore quoted here: Water and organic matter, 31.8 per cent. (containing nitrogen 0.35 per cent.); calcium carbonate, 50 per cent.; potash and phosphoric acid, traces.

Altered and Metamorphic Limestones.

Very often, owing to solution and re-precipitation of carbonate of lime by percolating water, the appearance of a limestone is so changed that its original character may be a matter of doubt. Such altered limestones usually exhibit what is known as a crystalline structure. Many limestones, especially those in the older rock formations, have been converted into the highly crystalline form known as marble by the combined action of water, heat, and pressure.

Some limestones, especially those that originally were somewhat impure, are found to contain great numbers of siliceous concretions. The flint nodules of chalk deposits are of this character. Again, a limestone, by the infiltration of water containing silica in solution, may be almost wholly changed to chert, a flinty form of silica or quartz.

* Aston, B. C.: 10th Ann. Rep. Dept. Agric., Chemistry Division, 1902, p. 119.

In this case most of the carbonate of lime has been removed in solution, and silica brought by the dissolving waters has taken its place.

When igneous rocks such as granite or diorite are intruded into limestone great changes may take place near the intrusive rock. The carbon dioxide of the limestone is largely expelled; and highly heated siliceous waters escaping from or associated with the igneous rock convert the lime into various silicate minerals, the chief of which are garnet, wollastonite, vesuvianite, diopside, and epidote.

Mode of Occurrence of Limestone.

The mode of occurrence of limestone has been more or less indicated on the preceding pages. In recapitulation it may be said that limestone occurs typically in widespread beds or sheets of variable thickness, enclosed in other sedimentary strata. Subsequently to their formation these strata have been upheaved, tilted, folded, broken, and subjected to denudation. Hence the limestone, once a continuous horizontal sheet, may be found in all kinds of positions, even in that of verticality. In some places large amounts of limestone may be exposed; in others either the amount of limestone is actually small, or the greater part is deeply buried beneath superincumbent strata. In such a case, if the structure and thickness of the enclosing strata are observed, it is possible to ascertain the depth of the limestone stratum at any given point. The mode of occurrence of non-stratified deposits of limestone, such as stalagmite, stalactite, travertine, slope debris (talus), calcite veins, &c., is sufficiently explained by their mode of formation.

Geological Systems and the Geological Time-scale.

The study of the sedimentary strata covering the earth's surface shows that in the aggregate they are of great thickness, and that their deposition has occupied a long period of time, probably quite 100,000,000 years.* The non-geological reader may perhaps need to be reminded that once none of the rocks he sees around him were in existence. This applies to the igneous rocks now exposed on the earth's surface as well as to the sedimentary rocks; but this bulletin is concerned only with the latter, except in the case of the so-called marble of Milford Sound, and possibly one or two other localities in western Otago, where masses of carbonate have been formed by some unexplained process in connection with igneous rocks.

The older sedimentary rocks are, of course, overlain by the younger, except where great earth-movements causing compression of the strata or complicated faulting have caused overturning, an occurrence that is only local, and is usually easily detected. Although, owing to elevation above sea-level alternating with depression, and owing to erosion during periods when the land emerged from the sea, the succession of strata is in no locality complete, nor can a complete record be obtained even by piecing together the data obtained in different localities, yet

* Estimates of the period in question vary from a few million years to 700,000,000 years or more. The lower estimates cannot possibly be accepted, the higher are more than doubtful. The earth itself, however, was formed long before the oldest known sedimentary rocks. From a geological point of view it would be reasonable to suppose its total age to be roughly 200,000,000 years. [This estimate is very conservative, and would be doubled or even trebled by many present-day geologists.—P. G. M., April, 1920.]

geologists, largely through the aid of fossils, have obtained a good, though imperfect, understanding of the past history of the earth. The sedimentary rocks have been placed according to age in several great divisions, known as the Palæozoic (at one time called Primary), Mesozoic (Secondary), and Cainozoic (or Tertiary) eras. The rocks formed during and since the time known as the glacial epoch, a time when ice invaded the lowlands of much of Europe and of the northern part of North America, are placed in the Quaternary era or age. The rocks of each era are classified, according to principles explained in works on geology, into systems each corresponding to a period of time, and these are subdivided into series, formations, and stages, the last-named subdivision representing what are called epochs of time.* The breaks in deposition caused by recurring elevation of the sea-bottom, or rather of portions of it, above sea-level are considered by all stratigraphical geologists of prime importance in delimiting the geological systems.† During times of depression the loss of material caused by erosion during elevation was made good by the deposition of new strata. A little reflection will show that these matters are of importance to the inhabitants of the earth. To take an illustration that directly concerns the subject of this bulletin: during periods of depression limestone deposits were formed, whilst elevation brought them within reach of man and has also led to their part loss through erosion.

It is known that the geological history of all parts of the earth's surface has not been the same. Local elevation and depression on a small scale has often happened without other parts of the earth, so far as known, being affected. On the other hand, it is believed that the major movements have been world-wide, and have produced results that can be traced on all parts of the earth's surface by one means or another. Hence geological systems established by study on one part of the earth's surface are thought to be applicable to other parts; but in many cases it is impracticable to trace the subdivisions of the systems made in Europe through the rocks of another continent or far-distant islands like those of New Zealand. Indeed, were it not for fossils, little could be done in correlating the rocks of one country with those of another, and almost the whole science of stratigraphical geology would be undone. Parenthetically it may be said that fossils are of tremendous importance not only to the science of geology, but also to that of evolutionary biology.

On account of the difficulty of correlation, local names are frequently used for geological formations and even systems, and the proposal has been made that in New Zealand the attempt to use the European time-scale should be practically abandoned. Though the use of a local set of system-names as an alternative to the European names is convenient and commendable, the European time-scale ought never to be lost sight of. Opinion, however, is bound to differ as to what amount of prominence should be given to it.‡

* Some authors use "age" as the time-term corresponding to "stage." Geological usage of these and similar terms is by no means uniform. See Arch. Geikie. "A Text-book of Geology," Vol. 2, p. 859, 4th ed., 1903.

† This statement will not be fully endorsed by all geologists, but the exceptions will be found mainly among those who pay great attention to theoretical considerations, or who have not had much to do with stratigraphical geology.

‡ A good statement of the case, but summing up against the European time scale, will be found in P. Marshall's "Geology of New Zealand," 1912, pp. 173-74

The following table illustrates the various geological systems represented in New Zealand :—

Era or Age.	System or Period. (European Time-scale.)	Corresponding New Zealand System.
Quaternary ..	Recent	Recent.
	Pleistocene	Pleistocene.
	Pliocene	Wanganui.
Cainozoic or Tertiary	Miocene	Oamaru.
	Oligocene	
	Eocene	Mawheranui or Waima- ngaroa.
		Waipara.
Mesozoic	Cretaceous	
	Jurassic	
	Triassic	Trias-Jura (Hokonui sys- tem of Park).
	Permian	
	Carboniferous	Maitai.
	Devonian	Te Apau (?).
Palæozoic	Silurian	Baton River. Part of Ao- rere (?).
	Ordovician	Aorere.
	Cambrian	Part of Aorere (?).
		Maniototo series of Park(?).
Archæan (= pre-Palæozoic)	Various divisions ..	Manapouri(?).

By consulting the classifications given by Park* and Marshall† the reader will ascertain that unfortunately there are still great divergences of opinion among New Zealand geologists concerning the classification of the sedimentary strata.

A table of geological systems like that given above is a time-scale as well as a rock-classification. The periods represented are, however, of very unequal lengths. Though in general geologists avoid stating ages in years, for the excellent reason that they are unable definitely to fix the length of any given geological period, yet estimates based on assumptions of one kind or another have been made. Various authorities consider that the Palæozoic periods were from 40,000,000 or 50,000,000 to 100,000,000 years or more ago, and the Mesozoic periods from, say, 8,000,000 to perhaps 40,000,000 years ago; whilst the Tertiary periods reach back less than 7,000,000 years. The Eocene may have begun 5,000,000 or 6,000,000 years ago, the Miocene 3,000,000 years ago or less. Pleistocene time is comprised within the last 200,000 years, and Recent time within the last 30,000 or 40,000 years.

At one time physicists wished to restrict the age of the earth, as reckoned from the beginning of life on its surface, to 25,000,000 or 30,000,000 years. The chief reason given was that the sun could not have poured out heat for a longer period. The discovery of radium has changed all that; and now some physicists, as the result of studies

* Park, James: "The Geology of New Zealand," 1910, p. 25.

† Marshall, Patrick: "Geology of New Zealand," 1912, p. 173.

on the radio-activity of rocks, assign most extravagant ages to them, such as 1,000,000,000 years and more. Some biologists and palæontologists, on evolutionary grounds, demand at least 400,000,000 years for the development of life on the earth to its present stage, but most geologists are satisfied with the 100,000,000 years mentioned above.

In New Zealand probably more limestone is of Miocene age than any other, but Pliocene, Cretaceous, and Ordovician limestones are also abundant.

ORCHARD SANITATION.

W. H. RICE, Orchard Instructor, Hastings.

SANITATION as applied to the orchard covers a wide range of factors important for the thorough well-being and vigorous health of trees. A consideration of a few of these points provides much food for reflection, and a careful system of sanitation well carried out will repay the orchardist not only by assisting him to control pests, but by furnishing primary means of preventing the spread of infectious diseases. "Infectious" is a term not generally used in connection with fruit-tree diseases, yet it is a term to keep well in mind throughout the control scheme applied to such diseases, conveying as it does just that note of warning we have been taught to respect in its true light regarding diseases of mankind.

SUNLIGHT AND AIR.

Sunlight and air are important points of all sanitation, and therefore merit serious consideration in connection with the orchard. One has only to examine trees adjacent to and shaded by shelter or other trees to see the spindly undeveloped growth produced where sunlight and air are partially withheld from the tree. This kind of wood is unable to give the necessary support to a payable crop of fruit, is readily susceptible to attacks from pests and diseases, and the trees are generally in a declining condition. It is better to allow a wider headland than create a slum part of the orchard. Compare this class of growth to the robust condition attained by trees that are in direct sunlight, and one is forced to the conclusion that light is essential throughout the orchard and throughout the framework of each tree. So the prudent orchardist endeavours to train his trees in a manner calculated to allow free access of light to all parts of the tree. Examination of a dense-growing tree of a lateral fruiting habit, subject to woolly aphis, further emphasizes the necessity of an open tree from the point of disease-control. Sunlight also has a distinct immediate commercial value, as the high-coloured fruits have a greater market value than poorly coloured specimens of the same variety.

A free circulation of air is required by trees for proper development. Shelter is a very important factor in fruitgrowing, but can be carried to excess and create a stagnant-air condition which is far from desirable. The best shelter no doubt is that planted a reasonable distance back from the orchard-line, but with closer settlement each occupier has to plant shelter on his own property to ensure permanency. This shelter-

belt should be of a nature which will not deflect the air-current altogether, otherwise the orchard, or at any rate the part adjacent to the belt, will become an air-pocket—calm, no doubt, when gales blow, but very oppressive at ordinary times. Such a condition has a devitalizing effect on the trees in this area. The ideal shelter should be open enough to permit a free circulation of air, yet break the force of wind. The opposite to overshelter is the forced draughts created by blank spaces in the belt, and sometimes by an entrance gate placed in the wrong position—such a draught will check considerably any trees under its influence.

ENVIRONMENT.

One of the essential points to ensure maximum development of plant-life is proper environment. Aquatic, alpine, bog, and various other species each requires its own particular environment in order to attain perfection. So also with fruit-trees is environment an important factor. One hears much about pedigree trees, and variation as regards precocity, regularity of cropping, &c., but no actual evidence has been brought forward to substantiate the claims of pedigree trees, and it remains to be proved whether bud-selection will perpetuate these desirable qualities. The exception is mutations or true sports, which vary only in colour from the parent. Experiments have failed to show that trees grown from one source will maintain the same character. On the contrary, the same relative amount of individual degeneracy or superiority is found, thus emphasizing the power of environment. Bud-selection is no doubt desirable, but protection from adverse conditions is absolutely necessary.

The rooting-area is worthy of more consideration than it usually receives—"out of sight out of mind" is not a fair way to treat this area. A deep, well-drained, sweet soil provides the required conditions for root-development; subsoiling or working to a great depth is not all that is necessary to make the soil deep. Depth suitable for root-action depends a good deal on the water-level of the land. Drainage is necessary for lowering this water-level in most soils. Many orchardists have had the disadvantages of soil-saturation brought to their notice by the loss of trees from sour-sap caused by the decay of root-fibre. Where free drainage is not available this happens to a certain extent each season, and much valuable root-formation dies out. Fertilizers are often used on land well stocked with plant-food, under the impression that the trees require feeding, when really the drainage is at fault.

Being assured of a deep soil, cultivation is necessary to ensure soil-sweetness or thorough aeration, as the life of beneficial bacteria in the soil is largely dependent on proper aeration. A fine division of soil-particles is more easily maintained with soils well supplied with humus. The modern usage of artificial fertilizers, which do not add humus to the soil, makes it advisable that some cover-crop should be grown and ploughed in to supply decayed vegetable matter, without which soils in time become unproductive for want of humus. The ground should be cultivated from the spring onward, often enough to maintain an earth mulch or open division of soil-particles a few inches deep. At the time of the last cultivation—with the early autumn rains—seed of a cover-crop may be sown to be ploughed in either in early winter or spring.

Spring ploughing has a much greater effect on the trees than is generally supposed. The early activity of the trees is supported by plant-food stored in the trees through the winter. Such activity is ahead of the root-action, and unless a further supply is early available from the roots the trees will receive a check, often severe enough to cause the newly set fruit to fall. Early ploughing will permit the soil to attain a much higher temperature than unploughed soil, with a consequent earlier root-action.

Good drainage, cultivation of the soil, with cover-crops turned in often to maintain humus, are, then, very necessary to ensure a sweet sanitary condition of the rooting-area.

CLEANLINESS.

We have impressed upon us by necessity the doctrine of cleanliness as applied to the control of human and animal disease. The nature of many fruit-tree diseases is such that the orchardist should exert himself to the utmost and apply many of the principles of domestic hygiene to orchard practice. A moment's thought will suggest many avenues through which improvement in this respect could be attained. The indifferent manner prunings are dealt with no doubt helps to perpetuate some of the diseases affecting fruit-trees. When pruning, the rule to cut out all dead wood is or should be applied, and close investigation usually shows that this wood has been killed by disease. Diseased wood is also rigorously cut out at pruning-time.

This should cause every grower to ask himself whether he is dealing with his prunings in the most sanitary manner. Such prunings are often bundled in a heap, dragged through the orchard, and tipped into a hollow or left on the headland till some other day. Disease usually attacks the weaker subjects in an orchard, and what better or more ready means of dissemination could be devised than this unsanitary practice of dragging about prunings? The heap of prunings left lying about is a much greater menace than seems generally recognized. Many diseases are surely difficult and costly enough to control in the parasitic stages on fruit-trees without thus providing a natural harbour where they may become saprophytic and rest until favourable conditions again permit them to attack the trees, often creating an epidemic. Weather favourable to fungoid diseases is usually unfavourable for spraying operations, so that a little cleanliness in time may be of more value than many gallons of spray under epidemic conditions. The best method to adopt in disposing of prunings is to destroy them by fire as soon as possible after being severed from the tree. This should be done without dragging the prunings about the orchard. A portable furnace can be used and moved about as required. A serviceable destructor to meet the requirements of the average orchard can be constructed from an old iron tank and a cart-wheel tire. Halve the circle of the tire, and open to form a rocker sledge by bracing with iron to support the tank. The latter is perforated at the bottom and lower parts of the sides to ensure a draught, and allow the ashes to be spread on the land as the furnace is moved. These ashes are of manurial value.

The thorough cleanliness essential to wound-healing can be applied to orchard practice. It often becomes necessary to remove large limbs, yet how often this is done with the same saw used to remove dead

and diseased wood, without any precautions being taken to prevent infection. Then, more often than not the wound is left with the rough edges untrimmed, so retarding the formation of callus—nature's covering for tree-wounds. A little care, such as trimming the bark-edge smooth with a sharp knife and covering the wood surface of the wound first with a disinfectant, will materially assist nature by preventing decay. An examination of numerous cuts suggests that very few over 3 in. in diameter ever heal right over, unless cut parallel with the part retained. The same pruning-tools are sometimes used on diseased and clean trees alike throughout the orchard. This is a common cause of rapid spread of such diseases as canker, and would be obviated by using a special pair of secateurs for the removal of diseased wood, or the sterilization of pruning-tools with corrosive sublimate of a strength of 1-1000.

Old cases, lids, tins, sacks, props, &c., are often left lying about in the orchard. This is not only untidy, it is unsanitary, as diseases and pests thrive in such haunts. Even a casual examination will often disclose several codlin-moth pupæ or mealy bugs safe in the home carelessly provided by the orchardist. Municipalities have lately adopted a clean-up week to improve the city sanitary conditions. This could also be applied with advantage to many orchards. One of the earliest methods of moth-control was to hunt them in the winter under loose bark, &c., and provide a summer-bandage harbour, which could be readily examined. More up-to-date control measures have rendered this bandage unnecessary, therefore the provision of any other harbour which is not so readily examined should be avoided. The orchard packing-shed should also receive attention, old cases being examined and treated, and bench cover-boards removed and examined. Many moth-cocoons may generally be found in the crevices of the sack packing-table so commonly used. It is surprising the number that can be located and destroyed in a short time, and when one considers the multiplication at infection-time the risk of wormy fruit has been considerably reduced by the destruction of even a few grubs in hiding during the winter. It is not uncommon to find cases of diseased fruit left lying about in the packing-shed—fruit which has decayed from a variety of rots and moulds, which are being propagated in countless numbers under such conditions and constitute a serious menace to future crops. All decayed fruit should be destroyed, and the shed cleaned up with the same care one would bestow on a dwelling.

IMMUNITY OR RESISTANCE TO DISEASE.

Disease-immunity is possessed by man, animals, and plants. Artificial inoculation, or recovery from a previous attack of disease, confers immunity in certain cases on man or animals, but the writer knows of no parallel in plant-life. Race immunity, however, applies to all alike. As special races of animal-life are immune to certain diseases, so racial varieties of fruit-trees are resistant to various diseases which do great damage to others of the same natural order. It is on this phase of resistance that we rely for predisposition or otherwise of trees to diseases, and although the road is a stiff grade for the plant-breeders they have given us many valuable varieties immune to special diseases. There remains yet another form of immunity—or, rather, partial

immunity—that assured by the maintenance of physical fitness, or, as applied to plant-life, vigour. Any methods which assist trees to attain and maintain a vigorous healthy state should be carried out. They will repay the orchardist financially, and ensure that pride of ownership which welcomes inspection.

PIG-RAISING NOTES.

K. W. GORRINGE, Instructor in Swine Husbandry.

No branch of live-stock farming gives better results than the raising of well-bred pigs when conducted with a reasonable amount of intelligence. The pig is one of the most important animals to raise on the farm, and no farm is complete unless some pigs are kept to aid in the modern method of farming. The pig requires less labour, less equipment, less capital, and makes greater gains per weight of concentrates supplied than any other farm-animal. It reproduces itself faster and in greater numbers, and returns the money invested more quickly. In some districts, owing to the dried-milk industry, most farmers have gone right out of pig-keeping, not having any product from the dairy to feed with. This should not have happened had the farmer been acquainted with the highly profitable method of grazing pigs on various crops. Instruction is now being given on this subject by the Department, and in view of the great shortage in pigs farmers should give the crop method their serious consideration.

PASTURES AND PASTURING.

The best way to manage pig-pastures is to have them divided off into two or more enclosures. These may then be alternated or rotated by removing the pigs from one paddock when the pasture gets short, and turning them into another when the forage is abundant and fresh. With lucerne this is especially desirable, because, by rotating, a certain amount of hay may be cut from the different enclosures in addition to the grazing. This system causes the lucerne to yield a maximum amount, betters the quality of the forage, and at the same time is good for the stand, in that occasional clipping seems to freshen and invigorate the growth, and too close and continuous grazing is injurious.

It has often been asked how many pigs can be grazed on one acre of various crops for a given time. In the following compilation may be found some useful averages, the pigs being reckoned as 100 lb. animals:—

Crop.	Number per Acre.	Number of Days.	Crop.	Number per Acre.	Number of Days.
Lucerne ..	13	132	Poa pratensis ..	13	118
Red clover ..	12	107	Wheat ..	14	90
Sweet clover ..	15	87	Rye ..	15	90
Rape ..	18	76	Sorghum ..	16	77

The season, the luxuriance of the growth, the size and development of the animals, and the amount of supplementary feed given have,

of course, important bearing on the number of head of pigs an acre of pasture will carry, but, as indicated, the figures represent average condition with the crops mentioned.

The results from the use of pasture crops seem to be practically all advantageous. The good results are plenty of much-needed exercise, with healthier and faster-growing pigs, less work, a saving of grain, and cheaper gains in weight—hence greater profit. Good bone and muscle are grown, the bowels are kept open, and the general condition of the pig is maintained at a high standard. Furthermore, the droppings of the animal enrich the land. In spite of any injury that may be done to the crop, and the expense of fencing, the best opinion is that pasture crops are necessary for profitable pork and bacon production.

RAPE FOR PIGS.

It seems to be not generally known that pasturing pigs on rape is a profitable operation, especially when supplemented by a 1- to 2-per-cent. ration of maize, barley, or other concentrates. Next to lucerne rape affords the most nourishing, succulent, and palatable crop on which to graze pigs. This fodder, so far, has not received the attention it merits from pig-breeders, but it will certainly become more popular as its merits for such feeding become better known.

Rape is considered one of our best catch-crops, and pigs turned in to graze the crop manure the soil. Rape is a better green feed for growing pigs than good clover pasture, pigs fed upon rape having made on the average 100 lb. of gain on one-third less grain than was required by the pigs fed on clover pasture. The pigs are more thrifty, have better appetites, and make greater gains when supplied with a rape pasture in conjunction with their grain feed than when fed on grain alone. Rape, in fact, may be claimed to be the most satisfactory and cheapest green food for pigs. Every feeder should plant each spring a small field of it adjoining his pig-yards, and provide himself with a chain or two of movable fence, in order to properly feed the rape to brood-sows and young pigs. Rape should not be pastured until the plants are at least 12 in. to 14 in. high. Pigs should not be allowed to root while in the rape feed.

It must be noted that in no instance is it advisable to depend on rape alone as a fodder for fattening pigs. Young pigs do well on this class of fodder up to the stage when they have to be fattened. It distends the digestive tract and renders it better able to digest a food richer in carbohydrates, such as maize, barley, pollard, skim-milk, or other foods, which may be given with rape to fatten. It is also well to remember that when stock are first turned in to graze on rape it is very laxative and liable to cause scouring. This means that until the animals become accustomed to the new diet they should be given only a few hours daily on the crop.

PREVENTION OF DISEASE.

Rotation of pastures is a valuable aid in the prevention of disease among pigs. A paddock that has been used continuously for many years becomes loaded with germs and the eggs of parasites, and a pig born into such surroundings has to fight for his life from the day of his birth. Pig-raisers should therefore arrange for a series of paddocks,

so that the pigs can be shifted occasionally. Plough up the old pig-run and grow some forage crop to which the pigs may be returned later in the season. This not only gives a double use of the ground, but cleanses it of germs and parasites. The practice likewise promotes the vigour of the animals by providing natural wholesome food and exercise in the sunshine, thus increasing their power of resistance to disease.

Sanitation is both a preventive and a control measure. It should be the object of the owner first to prevent disease by providing the proper surroundings. Animals that are forced to live in dark, damp, uncomfortable quarters, wading through filth, rooting their food out of the muck, and drinking polluted water cannot thrive as well as those kept under sanitary conditions. Houses and yards should be located in a well-drained place, which can be kept reasonably clean; also an adequate supply of pure water is essential. Germs retain their disease-producing power for long periods in damp, dark houses; therefore the pig-sty should be flooded with sunshine and properly ventilated. Sunshine is nature's great disinfectant. It is one of the things of which New Zealand has an abundant supply, and no pig-breeder should be guilty of harbouring disease in his herd because he has excluded from the pig-houses (whether permanent or portable) this great cleansing force.

The houses should be thoroughly cleaned of all manure and litter, and sprayed with a reliable disinfectant. The wash should be made thin enough to be applied with an ordinary spray-pump. Limewash is in itself a fair disinfectant, and, being sprayed, has the advantage of being driven into cracks and crevices not easily reached by a brush; moreover, it is easily seen, and serves to indicate the thoroughness of the work. Lime should be sprinkled about the pens. Much good work may be done but the object of it all defeated by neglecting an old runway under a building where sick pigs have been lying.

Exercise is highly important, and is one of the chief means of keeping the sow and her litter healthy. A roomy lot or yard is all right, but when the pigs are old enough—say, at two or three weeks—the sooner they are allowed pasture and range the better. They have a tendency to stay in the nest for warmth. Anything that will make them exercise—placing feed and water at a distance, scattering feed, or even scaring them into scampering out of the nest—will be found of value. Little pigs, however, should not be exposed to cold winds or cold rains. In the summer-time when lucerne and other pasture is available the position is easier, for the pigs will range for themselves and get the needed exercise.

The writer's object is to point out the principles underlying health and disease, and to outline the methods which the pig-raiser may employ in combating the common troubles. He should consider whether he is giving his pigs a fair chance for their lives. The pig is not a dirty animal; it will keep clean if the owner gives it the opportunity, and will amply repay all efforts to keep it in health.

Ensilage.—At the Stratford Model Dairy Farm, in February, 96 tons of specially-grown crops were put into an ensilage stack.

LAYING OUT THE FARM HOMESTEAD.

THE HORTICULTURAL ASPECT.

W. H. TAYLOR, Horticulturist.

It may be mentioned in the first place that the recommendations which follow are intended to apply specially to the homesteads of smaller farmers, such as do not employ a gardener or handy man to attend to the garden, &c., but perform the work themselves or with the assistance of their family.

In securing satisfactory results and a pleasing appearance for the homestead a great deal depends on initial arrangements. If these are good the way is made plain for future improvements, which usually must come by degrees. Roads that pass close to a house should be avoided, and also arrangements of stables, sheds, &c., that will lead to a horse and dray traffic close to the back door, resulting in a perpetual state of mud and untidiness. On a farm of no greater extent than 50 acres an acre or two can well be spared for the homestead and its surroundings. Provision should be made for a small orchard—say, half an acre—a vegetable and small-fruit garden, a drying-green for the washing, a small backyard with outbuildings, and a garden in front of the house at least, preferably extending to the sides also.

In determining the plan for laying out the grounds convenience should be the first consideration. If convenience is taken as a guide there will never be any difficulty with the design. The access road should be kept a few yards distant from the house, so as to leave room for a belt of low-growing trees and shrubs. There should also be another entrance to approach the back of the house. Only one fence is required, which should be on the farm side of the entrance road. The farmyard with its necessary buildings should preferably be on the farm side of the enclosing fence, or at least well away from the back yard of the house. The road should be well graded, raised in the centre, and have water-tables to carry off rainfall. A low-growing hedge that could be easily kept should bound the road on the house side. Inside this shrubs and trees might be planted as a screen. Care should be taken not to plant trees that grow to a great height; they would overhang and darken the place and make it sombre-looking, besides becoming unsightly.

Where road-metal is easily obtainable some of the natural soil should be removed from the road and the space filled with metal; it is impossible to make a good road otherwise. Paths around the house are a necessity, but they should be strictly limited to serve a useful purpose. They involve labour in keeping them in order, and if neglected they become an eyesore. The paths should be made a few inches lower than the surface of the plots through which they pass, and should serve to some extent as drains for the garden. If a foot in depth of the soil can be removed and its place filled with good metal, blinded with gravel, a dry path will result that can be kept clean with a minimum of labour.

THE FRONT GARDEN.

The best form of garden to lay out in front of a house is one mainly composed of grass. Mixed flower-gardens are liable to be neglected at times and to look untidy, and when a garden has once been neglected and weeds allowed to seed it can rarely be brought into good order again. A lawn does not look very untidy even when not well kept all the time, and it is tidy again as soon as the grass is cut—in fact, the grass is improved if allowed to get long occasionally, as the roots are strengthened. A few flowering shrubs or trees of a suitable habit planted on the grass improve the appearance, and if it is well kept there is no objection to a narrow border for mixed flowers, though on the whole it may be best to omit the border. The trees planted should be of moderate growth. A large tree is quite out of place on a small lawn. Among others, such trees as the various *Retinosporas*, *Cupressus elegans*, *Cupressus Lawsoniana erecta viridis*, *Cedrus deodara*, *Photinia glabra*, weeping-elm, weeping-lime, weeping-ash, also the upright lime, which give shade in summer and can be kept cut if needed, are suitable for the purpose. All are trees that can be allowed to grow naturally, or if any trimming is required it would be such as would not disfigure the tree. There are also a number of flowering-shrubs that could be planted. There is always a temptation to make beds for flowers, but this should never be done unless it is intended to fill the bed with only one kind of plant. A mixture of plants in a small bed always leads to untidiness, and should be avoided. Flower-gardening of a mixed character can better be carried out on borders running along the side of a house. These borders should be devoted to flowering-shrubs, roses, and any other flowers desired. A comparatively narrow path could be bordered with violets, primroses, pinks, thrift, arabis, aubretias, or any similar plants, thus making full use of space.

By an arrangement of this kind the types of gardening are kept distinct, and the portion in front of the house is always in a presentable condition. The whole plan provides for cleanly surroundings and the avoidance of horse and dray traffic or wandering cattle around the house with its necessary accompaniment of mud.

THE ORCHARD AND VEGETABLE-GARDEN.

Every farm should have a small orchard to supply home wants, also a properly laid-out vegetable-garden. Shelter by trees is sometimes an absolute necessity, and it is always advisable. The amount of shelter necessary will, of course, vary in accordance with local conditions and be ruled somewhat by the desires of the owner. An effective shelter for small areas is provided by a single or double line of Lombardy poplars. These trees take up very little ground-space, and are easily topped to prevent them getting too high. The thinnings may not have much value as wood, but will, if burned, produce a valuable amount of potash, which will benefit the trees and garden crops. If *Elæagnus* be planted among the poplars it will make a very dense belt by climbing the trees, and in such a position will require very little trimming.

The orchard land should be well prepared by deep ploughing. Subsoiling is usually necessary to provide a deep-rooting medium.

Drainage should also be attended to if required. There is no reason why the orchard land should be unproductive in the years before the fruit-trees come into profit. It would be better not to plant fruit-trees at all unless some plan was made which would ensure them being properly cared for, and where the small farmer is concerned the plan must be one that will ensure adequate return for the labour expended. The space between the fruit-trees may be sown down with red clover or lucerne and a considerable quantity of the crop used as forage. It pays to apply fertilizers, both to benefit the forage crop and to save depreciation of the soil. Such crops also save cultivation, except a small area round each tree, and prevent the growth of noxious weeds. Another plan is to grow potatoes, which should be a good crop if the soil is properly prepared for the fruit-trees. Still another system is to utilize the orchard ground for general vegetable crops, in which case it would be wise to lay down the area that will eventually be the vegetable-garden in lucerne or clovers for forage purposes. When eventually this area is required for vegetable-culture by reason of the fruit-trees in the orchard having come to profit, the lucerne or clover will have greatly enriched the soil and improved its working-condition, and incidentally have been profitable the whole time.

SMALL FRUITS.

A good supply of small fruits should be regarded as a necessity for the homestead. If well-selected varieties be planted after suitable preparations have been made such a garden is bound to be a source of both profit and pleasure. The area planted should be such as there is reasonable prospect of maintaining in good order, otherwise it may prove an annoyance and loss. The amount of produce depends on a good selection of varieties and efficient cultural methods rather than on the numbers planted. The soil should be deeply worked in the first place, and all weeds of a perennial nature worked out before anything is planted. Usually it will be best to put the land under potatoes for a season. The thorough tillage required for this crop cleans the soil and brings it into good working-order, and should give a return covering all the cost of preparation and possibly going a long way towards the purchase of plants.

A word of warning may be necessary here. With small fruits poor varieties give no satisfaction, while badly trained bushes are a nuisance and a waste of labour. Getting cuttings from a neighbour's garden may lead to complete failure, so also may buying the cheapest plants from a nursery. Some people look for the lowest-priced plants; such plants are a delusion and a snare. Purchase only the very best and you get satisfaction from them.

Farmer's Glory is the best gooseberry to grow, and unless a succession is wanted it would be best to grow no other. The bush is a good grower, of fairly good habit, and produces prolific crops of large berries. To make good bushes the cuttings should be nearly 15 in. long. All the buds except four or five at the top should be carefully cut out. The result is a bush that will not sucker and that will have a clean stem of about 8 in. between the surface of the soil and the branches. Such a bush is easily kept in order, the fruit is easily gathered, and soil-cultivation is easily done. Red-currant bushes should be raised in the same

way and for the same reasons. They give an abundant crop if the right varieties are planted, while some varieties seldom produce more than a few scattered berries. La Versailles, Chenanceau, Cherry, and Fay's Prolific are good varieties.

Black currants are subject to the borer, which destroys branches, and bushes can be maintained only by frequently renewing the branches. This is effected by not removing the buds on the cuttings. This causes the bushes to send up branches from below the surface, creating what is known as a stooling habit. Old branches are removed from time to time, leaving young branches in their place. The stooling habit is not objectionable with this bush, the growth being upright and free from thorns. Care should be taken to avoid planting them where sorrel or couch-grass abound, as their roots could not be got out from a stooling bush. Good varieties are Carter's Black Champion and Kentish Hero.

Raspberries require a fairly deep and moist soil; it is useless to plant them in very dry situations. Success largely depends on allowing them time to become established before letting them bear fruit. Old canes are not suitable for planting; young well-rooted suckers that spring clear of the stool are best. Cut them down to about 6 in. or less. A fair crop can be had the second year, and the third year should see them in full profit. Fillbasket and All Summer are two of the best varieties.

TREATMENT OF UNRIPE HONEY.

SUCCESSFUL EXPERIMENTS IN VACUUM BOILING.

G. V. WESTBROOKE, Apiary Instructor, Auckland.

AMONG the difficulties that beekeepers have sometimes to contend with is that of dealing with unripe and fermented honey. It occasionally happens that honey when extracted contains an excess of moisture, and this after a few months causes fermentation to set up, thus spoiling the honey as an article of food. While in many cases this could be prevented by seeing that all honey is capped over by the bees before removing it from the hives, and by avoiding extraction or leaving the honey exposed during damp weather, yet it sometimes happens that in spite of care the honey contains too much moisture.

By the use of the hydrometer it is possible, however, to ascertain if the honey is ripe before putting it on the market. After some years of testing it is now generally recognized that honey showing a specific gravity of not less than 1.42 is quite safe to keep for some considerable time. Therefore, as no up-to-date beekeeper should fail to test his honey before forwarding, there should be no excuse for the quantities of honey that arrive at the grading-store in an unripe condition. The greatest difficulty, however, has been to know what to do with such honey when it is found to be below the standard gravity. In the past it has been the custom to sell fermented honey to manu-

facturers for vinegar-making, &c., at from 1d. to 2d. per pound. This matter of fermentation thus meant a considerable loss each year to the beekeepers concerned—probably well over £500 per annum in the aggregate.

With a view to saving the class of honey in question experiments were recently undertaken at Auckland by the writer, which give promise of great possibilities. Small samples of honey that had slightly fermented, and which showed a specific gravity of only 1.405, were first dealt with. These were boiled for about ten minutes in a vacuum flask at a temperature of 130° F. This boiling at a comparatively low temperature resulted in ridding the honey of its surplus moisture, also in eliminating the froth and particles of wax, &c., leaving it very clear. After this treatment the honey showed a specific gravity of 1.425.

These small experiments were so encouraging that arrangements were made to treat a large quantity at the Colonial Sugar Refining Company's works, and in conjunction with the New Zealand Honey Producers' Association about 6 tons of slightly fermented honey was secured from different parts of the Dominion. This honey on being tested registered from 1.4 to 1.405, and analysis showed that the water-content was about 20 per cent. As the honey was more or less granulated it was found necessary at the sugar-works to reliquefy it by adding about 25 per cent. of hot water. This also enabled it to be pumped into a large vacuum-vat. It was then boiled for over half an hour at a temperature of 120°. During the process of boiling several tests were made by the writer, and when a gravity of 1.425 was registered the heat was shut off and the honey run into tins. It finally registered 1.432, which indicated a very ripe honey.

This honey now shows no trace of fermentation, nor are the germs likely to again become active, as there is not sufficient moisture to allow them to do so. The honey prior to treatment had rather a strong, rank flavour and aroma, which has now disappeared, thus considerably improving its quality, although it may be slightly darker in colour.

The success of this experiment should justify the Honey Producers' Association in procuring a vacuum-vat for treating all honey that does not come up to the standard required to avoid fermentation. Such honey should be treated before the ferment germs start in it, thus effecting a large saving for the industry.

The thanks of the Department as well as those of the beekeepers are due to the management of the Colonial Sugar Refining Company for their willing assistance in the carrying-out of the experiment.

Milking Shorthorn Breeders.—A meeting of the Council of the New Zealand Milking Shorthorn Association was held at the Ruakura Farm of Instruction homestead last month, being presided over by Mr. A. W. Green, this year's president. Some fifty members of the association joined the Council after the meeting, and the party spent the afternoon inspecting the Milking Shorthorn cattle on the farm. The southern breeders expressed surprise at the high quality of the Ruakura stock.

RED MITE AND WOOLLY APHIS ON NURSERY FRUIT-TREES.

CONTROL TESTS AT ARATAKI.

W. H. RICE, Orchard Instructor, Hastings.

EXPERIMENTS were again conducted at the Arataki Horticultural Station to determine the best winter control for red mite and woolly aphis on orchard nursery stock, the tests being on similar lines to those recorded in the *Journal* for April, 1919.

The treatment, given on 5th June, 1919, was as follows :—

Lot 1 : Dipped in red oil, 1-6, 1-8, 1-10, 1-12 ; ordinary dipping, well submerged, then taken out.

Lot 2 : Dipped in oil at same strength as lot 1, but trees submerged for three minutes.

Lot 3 : Dipped in lime-sulphur, 1-6, 1-8, 1-10 ; ordinary dipping, well submerged, then taken out.

Lot 4 : Dipped in lime-sulphur at same strength as Lot 3, but trees submerged for three minutes.

All these treatments were varied by one set being dipped to ground-level only, and another set totally submerged, roots included. The whole of the series was also duplicated to allow of treatment on 24th July. Two-year-old Jonathans were used in all the tests, and one pear and one plum were subjected to each treatment to note the effect on the trees.

Examination of the trees at specified dates showed the following results :—

7th October : Lots 1 and 2, no red mite or mite eggs on oil 1-6 ; eggs only on oil 1-8, 1-10, and 1-12. No woolly aphis showing on oil-treated trees. Lots 3 and 4, mite eggs and aphis showing on all lime-sulphur-treated trees.

3rd November : Lot 1, no mite or mite-eggs on oil 1-6. Live mites and eggs on oil 1-8, 1-10, and 1-12. Aphis showing on oil 1-12. Lot 2, no mite or mite eggs on oil 1-6. Eggs but no live mites on oil 1-8, 1-10, and 1-12 ; no aphis showing. Lots 3 and 4, live mites and aphis showing on all trees treated with lime-sulphur.

13th December : Lots 1, 2, 3, and 4, live mites and summer eggs on all trees. Oil 1-6 trees evidently reinfected. Aphis on all trees, but less on lot 2, oil 1-6, 1-8. Bad on all lime-sulphur-treated trees. It is possible the trees in lot 2 were reinfected with mite from the adjoining trees.

In regard to root-immersion, with apple and pear there was no injury due to such immersion on either date. With plum, root-immersion in oil at any strength tried on both dates retarded bud-expansion by nearly a week, but trees finally burst into growth undamaged. Root-immersion in lime-sulphur did not retard bud-movement.

CONCLUSIONS.

Lime-sulphur has proved useless as a winter control for red mite or woolly aphis.

Woolly-aphis control is best assured by a three-minutes immersion in oil not weaker than 1-10.

Red-mite control cannot be assured with oil weaker than 1-6, even when submerged for three minutes, though all oil treatments retarded hatching of eggs.

Root-immersion of apples or pears is not injurious, either when done as the trees are lifted from the nursery early in June, or later at planting-time late in July.

Plum total immersion in oil 1-6 to 1-12 retards bud-movement fully a week later than dipping only to growth-level at a similar strength. This applies to both dates of treatment.

The results in the main confirm those of the previous year's tests.

Control of Pennyroyal.—Pennyroyal thrives in wet, sour land, and to get rid of it wet places must be drained and steps taken to sweeten the land by liming and general cultivation. It is good practice to grow one or two good smother-crops, such as rape and green oats, before sowing down to pasture. Patches of pennyroyal showing in the new pasture may be killed by spraying with arsenic solution, made up as follows: 1 lb. arsenic, 1 lb. caustic soda, 20 g. llons water. To clear pennyroyal from unploughable land the same spray may be used. A heavy dressing of salt and most of the proprietary weed-destroyers will also kill pennyroyal, but it is found that the arsenic preparation is the cheapest. As the arsenic spray is poisonous, stock must be kept off the sprayed pasture until after a good rain.



HARVESTING BOBS WHEAT AT RUAKURA.

WORK FOR THE COMING MONTH.

THE ORCHARD.

THE FIRE-BLIGHT CAMPAIGN.

THE appearance of fire-blight in New Zealand is naturally the cause of considerable anxiety to fruitgrowers, when the highly destructive nature of the disease and the rapid manner in which it has spread in a single season, in the Waikato and other districts of the Auckland Province, are taken into account. As might be expected in the circumstances, more or less scare articles have been appearing in the Press relative to fire-blight, its previous existence in the country, lack of appreciation on the part of the Department, &c. These statements have been mainly based on an erroneous conception of the position and a lack of knowledge as to the habits of the disease itself.

The object of the present remarks is to allay anxiety, so far as such can be done when dealing with what is fully recognized to be a serious menace to the orchard industry, by assuring the public that the Department fully realizes the seriousness of the position, and is doing, and fully intends to continue to do, all that is reasonably possible with a view to relieving the industry of this menace as early as possible. To this end the Horticulture Division is receiving the full support of the Minister and of the Director-General of Agriculture, and is working in the closest co-operation with the Biology Section of the Department.

Mr. G. Esam, who has been for some time Acting Assistant Director of the Horticulture Division, has been placed in charge of the work in the affected area, and has been given full authority to engage all reasonable assistance required to cope with the situation. This work practically means a tree-to-tree inspection in each affected locality, the cutting-out of diseased wood of moderately affected trees, and the destruction of those badly affected, prior to the danger period of next season, which, according to the behaviour of the disease in America, is from the commencement of the flow of sap until the hot weather of the summer sets in, or shortly after the blossoming-period is over.

The hawthorn is no doubt an important as well as an interesting factor in connection with fire-blight. The hawthorn is readily affected, and, owing to its profuse blossoming habit, may hold and transmit the disease by means of insects to other susceptible plants for some time after the initial infection. This, when considered in conjunction with the numerous hedges of hawthorn, may readily account for the erratic spread of the disease in the affected areas. On the other hand, direct information received from the Bureau of Plant Industry, Washington, U.S.A., is to the effect that the hawthorn has not been found to carry "hold over" cankers in that country. This means that the disease

dies out on hawthorn each season, and that it cannot reinfect other plants until it becomes reinfected itself. Although the hawthorn will be closely watched and investigated in order to definitely determine its behaviour in this country, it is not considered advisable to undertake the wholesale destruction of hawthorn hedges, but it is highly essential that no diseased plants should be left in the vicinity of a hawthorn hedge, otherwise a reinfestation to the hedge is likely to occur, with a wider spread of the disease to follow.

Judging from the public statements which have been made from time to time, there appears to be an idea that fire-blight is not new to New Zealand. All the writer wishes to say in this connection is that no evidence has at any time come under the notice of the Department to warrant this supposition. In all cases in the past such cankerous attacks and dying wood of a suspicious character have been submitted to the Biologist for examination. His report that the present is the first case of fire-blight which has come under his notice in New Zealand is amply supported by the behaviour of the present disease when compared with that of any other, however closely such may have outwardly resembled the present disease.

AUCKLAND.

May can be regarded by the orchardist as the close of the fruit season, and attention may be given almost entirely to a general cleaning-up of the orchard, sheds, spraying-apparatus, &c. This work should include the collection and burning of all mummified fruits that may be still hanging on the trees or lying on the ground.

Intending planters are advised to get the work of preparation of ground for planting well in hand. If left until after May the ground will probably be in too wet a state to permit the carrying-out of successful work, more especially on the heavier class of gum lands.

Before all the leaves fall opportunity should be taken to mark any trees affected by silver-blight, so that the desired treatment may be given while they are in the dormant and semi-dormant stages.

Spraying for woolly aphid and San Jose scale on apple-trees may be carried out at the end of May with red oil, 1-25.

Instructions for the control of fire-blight in affected areas have been given elsewhere.

—J. W. Collard, Orchard Instructor, Auckland.

HAWKE'S BAY.

The marketing of late varieties of apples will still take up a good deal of time. Other seasonable work will be to thoroughly clean up the orchard.

Following such a dry season as we have just experienced, early autumn ploughing should be done as soon as possible, breaking up the land thoroughly to allow easy penetration of all rain and ensure a thorough saturation of the subsoil, thus taking advantage of all rainfall. The land should be ploughed towards the trees, leaving the furrow in the centre of the rows, with the fall of the land to provide an easy get-away for surplus water should the winter prove to be a wet one. Neglect of this precaution creates an altogether undesirable waterlogged area in many orchards, and often a considerable loss of root-system due to decay.

The pruning of stone-fruit trees should be done as soon as the trees are in a fit condition. Pruning may be done any time after the foliage has fallen, and should be carried out so as to avoid a rush of work later in the season, as is often the case when all the pruning is left till well on in the winter.

Spraying: Stone-fruits—Die-back and rust, bordeaux 8-6-40; die-back and rust and San Jose scale, lime-sulphur 1-15. Pears—Blister-mite and San Jose scale, lime-sulphur 1-15.

—W. H. Rice, Orchard Instructor, Hastings.

NELSON.

With the month of May comes the end of the orchard busy season, and an opportunity to attend to the many odd jobs that are always waiting. The spray engine and pump will doubtless want overhauling and some refitting. The present brief interval is the best time to get this done. Hedges will require trimming and fences to be mended; gateways will need fixing and metalling; there are also private roadways to be mended, not forgetting the water-tables and culverts. This brings one to what is perhaps at this time of the year the most important job of all—drainage. This subject should be well considered and the drains receive their annual cleaning-up. Efficient drainage is one of the main factors in securing a good orchard crop. Washouts and scours will mostly be avoided if this matter is attended to now.

If any planting is to be done this year preparations should be commenced without delay. If the land is in grass, skim it, and allow the herbage to rot before cross-ploughing and subsoiling. As this takes time, begin the job now and give the trees a good start. Shelter and plantation planting will also need consideration. It is useless to complain of the scarcity of timber when the remedy is in our own hands. Pines, gums, spruces, and redwoods grow freely here, as well as the deciduous exotic trees. Why go short of firewood and case timber?

—*W. C. Hyde, Orchard Instructor, Nelson.*

CANTERBURY.

With the advent of May the picking and marketing season will be almost finished, except for those who have taken advantage of cool storage. In such cases it will be wise for growers to examine the fruit at intervals and place it on the market at the proper time, remembering that no variety will keep in cool store for an indefinite period. This particularly applies to those growers in this district who are storing Lord Wolsleys.

Growers intending to plant new orchards this coming season should spare no efforts to get the land in good order. Subsoil where necessary, and when planting see that only good trees are put in; weak trees are a constant source of trouble and very rarely pay ground-rent. Strong, well-grown yearlings are advised.

May will also see the commencement of pruning operations, especially with stone-fruits. Many growers in this district have been too sparing with the knife, especially on peaches and nectarines, with the result that all fruit is borne at the tops of the trees, leaving bare branches underneath. Stone-fruits, when in bearing, need much harder cutting than pip-fruits, not only to promote good new growth, but to furnish the lower parts of the tree with fruiting-wood.

Any drainage required in the orchard should be attended to, and existing drains cleared out, so as to allow them to work properly during the winter.

—*G. Stratford, Orchard Instructor, Christchurch.*

OTAGO.

With the exception of woolly aphis, and in some instances red mite, the fight against insect pests will now be over for the season, but as soon as the foliage commences to fall growers will be well advised to turn their attention to preventive measures against fungoid disease of stone-fruits. Chief among these diseases is shothole of the apricot, and in many instances this has also been very prevalent on plums, and to a smaller extent on cherries. Leaf-curl of the peach has also been prevalent. Rust does not appear to have been as bad as in the previous season, but still it has been in evidence. All affected areas will be the better at this time of the year for a dressing of bordeaux, 6-4-40, so as to get as many of the spores as possible now. Where die-back is likely to occur this application is very essential.

The apple crop being a good one, possibly more growers will be placing apples in cool storage than formerly. Grade and pack carefully, eliminating all doubtful fruits and those punctured by insects and other causes. It is not profitable to pay out cool-storage charges on inferior fruit. Despatch the fruit to cool store as soon as it is picked if the maximum results are desired.

Where trees are needed for new areas and replacing, no time should be lost in placing orders for these. In doing so stipulate the trees required—their age, grade, &c. Growers are often too lax in this respect, and much trouble and disappointment could often be avoided if they were more businesslike. A perusal of the nursery regulations will assist planters to get only what they want.

—*J. H. Thorp, Orchard Instructor, Dunedin.*

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

MANAGEMENT OF THE LAYERS.

ON a great many poultry plants May will prove one of the most trying and disappointing months of the year, for the reason that much will be going out and little coming in. It is a time when the difference between good and bad management is most marked. To the man who manages the business properly, rigorously culls out unprofitable stock, has only the best of the second-season hens on hand, has no superfluous male birds, and has a flock of pullets in a laying-condition, the month of May should show a good return over cost of production. On the other hand, to the poultryman who has neglected to cull his inferior stock and does not possess the necessary number of pullets, or, if he has a good flock of these, has overcrowded his houses owing to the larger number of old birds on the plant, next month will probably show a loss instead of a profit.

Of course, even on the best managed of plants the pullets must be chiefly relied upon to lay at this season of the year, as few adult birds in any flock will be in a laying-condition. Therefore, if a good yield of eggs is to be gathered, it is necessary that the pullets should have everything in their favour. In this connection it must be remembered that the birds are being called upon to lay eggs out of their natural season, and therefore must be handled with the greatest care. In other words, artificial conditions must be provided as far as possible in order that the birds may be able to withstand extreme weather conditions and at the same time produce what might be termed an artificial product. In the first place, the houses must be roomy, so that the birds will have ample space to exercise under cover when cold and wet weather conditions prevail. They should be fed in the house at all times, and induced to exercise as much as possible by being compelled to scratch in dry litter for their grain ration. Do not on any account neglect to provide the pullets with as much food as they can eat. The cost of foodstuffs is certainly high, but so is the price of eggs, and the birds will show a handsome profit over their keep if fed to the best advantage. Notwithstanding the high cost of food, the present price of eggs gives every inducement to the poultry-keeper to feed his birds to their maximum capacity. Unfortunately, when food is dear there is always a tendency on the part of many breeders to give their fowls a mere living-diet. This is obviously false economy of the worst form. Indeed, the most important principle in the management of utility poultry is to feed them well from first to last, and it is impossible to overfeed the bird of the laying temperament.

An exception to the latter statement may be made—namely, that it is possible to overfeed if the food is not of the right quality. For instance, the feeding of a nitrogenous material, such as meat or its substitutes, may be easily overdone. Such food is specially demanded for the manufacture of the winter-egg product of the modern fowl, but it should be used with the greatest care. Especially is this so when the meat is included in a mash mixture, as when fed to excess it may easily do more harm than good. The only safe course when

using forcing-foods is to feed them separately, so that each bird may obtain all it requires and no more. Of course, 5 or 6 per cent. of meat-meal, &c., may be added to the morning mash with safety. Where the danger lies is in compelling a bird to eat an oversupply of it in order to secure a meal. Particularly is this the case where young pullets are concerned, as excess of meat is apt to bring on ovarian troubles, such as protrusion of the oviduct, to say nothing of the double-yolked and shell-less eggs that are likely to be produced. The best course is to provide a plain mash made up of pollard, bran, ground grains, &c., and make this as appetizing as possible by moistening it with meat-soup, skim-milk, or hot water. Then if the meat diet and green-stuff is fed separately the birds will have an opportunity of balancing their own ration, and usually they can be depended upon to do this better than we can do it for them.

Even where a meat diet is fed by itself there is always the risk of the birds eating too much of this, with injurious results, if the grain and green-food materials are not supplied with a free hand. In addition to generous feeding, gravel, grit, crushed oyster-shell, and clean water should be always before the birds, while strict attention to cleanliness is of the greatest importance.

Perhaps the main point in managing the pullets that are bred to lay in winter is to prevent them from going into a premature moult. In this connection the worst mistake that can be made is to change the quarters or change the diet, more especially when the bird is commencing to lay. As a matter of fact, any change in the method of feeding and general management is simply inviting the birds to moult. Probably there has been no season in which the false moult has been more prevalent than the present one. This has been due chiefly to too many changes in the system of feeding, owing to the inability of poultrymen to secure an adequate supply of wheat, and thereby having to resort to substitutes for this much-favoured but scarce grain material.

THE MOULTING-PERIOD.

A common weakness of system on many plants at the present time is to reduce the ration of the adult stock merely because they are moulting and therefore not in a laying-condition. It should not be forgotten that producing feathers is often more exhausting and places a greater strain on the bird's system than the production of eggs. It is therefore essential that the moulting birds should be well fed and given every opportunity to maintain their bodily vigour and withstand the strain which the renewing of feathers imposes. In addition to good liberal feeding, the birds should be well housed, and, above all, they should not be subjected to draughts. It is also necessary to protect them from being exposed to cold and wet weather. Never compel them to stand in the cold, wet yard waiting for feeding-time, as such exposure of a half-naked bird must obviously have an undesirable effect on it. As is the case with birds of all ages at this time of year, they should be fed in the house, so that they will secure all the food they require without having to go out into the open on cold, wet days. The moulting process may be assisted by adding to the mash some flowers of sulphur, allowing a tablespoonful for every twenty birds. No care and attention is too good for the moulting hen.

If she has been considered sufficiently good to retain in the flock for another year, then she certainly deserves to be well done by, even although she is temporarily out of action. The amount of care and attention she receives now will largely influence the time when the productive season again commences.

THE APIARY.

G. V. WESTBROOKE, Apiary Instructor.

PACKING FOR MARKET.

THE packing of the surplus honey for market should now be claiming the attention of the apiarist. This is an important matter which has been much neglected in the past. If the producer could see the deplorable condition in which his honey sometimes arrives at the grading-store or local depot after a journey by rail or steamer he would give more attention to its packing. The graders have frequently to complain of lids of tins being off, and where the honey is not granulated a considerable amount is often wasted. The leakage of honey, however, is not the only loss: it results in messing up all the adjacent cases.

There is another and more serious objection to such leakage at this time of the year, and that is the danger of spreading disease where the honey comes from an apiary infected with foul-brood. The writer recently saw a lorry-load of honey arriving at the depot simply surrounded by bees robbing the honey that was leaking from the tins. Assuming that some of this honey contained spores of the bacteria of foul-brood, then the result would be a most serious loss to those who have hives in the vicinity, through the bees bringing home the infected honey.

There would be no occasion for alarm of this sort if the beekeeper would use a little common-sense. The first essential is to see that the tins are strongly made. When they are filled the next care is to make sure that the lids are placed firmly in position. A stout wad of paper or a small block of wood should be placed on the lid of each tin. This will prevent it coming out when once the lid of the case is nailed down. The nailing-down of the case-tops is another matter that requires consideration. Cases frequently arrive at the grading-store appearing as if the intention of the beekeeper was that they should never again be opened. Sometimes as many as sixteen large nails have been driven in the lid, the result being that it had to be smashed to pieces before it could be removed, entailing a new lid for which the beekeeper had to pay, besides the extra time taken up and the waste of nails. Three 2 in. nails at each end should be sufficient to carry the cases to the grading-store, whether by rail or sea. Then, again, where the strapping is done prior to grading it is only necessary to nail this on the two sides and bottom of the cases, leaving the ends of the wire or strapping to lie on top of the tins *under* the case-tops. These will be securely nailed when graded.

Where honey is intended for export it should not be sent to the grading-store until it has granulated firm, otherwise charges for storage will mount up, which would be saved if the honey were kept at home. Honey will not be graded until it is firm.

Another matter the attention of the beekeeper should be directed to is the branding of the cases. These should have the registered number or brand on one end of the case only. In some instances it has been found that the stencil has been placed upside down. This results in needless labour at the store, as in such cases the bottoms of the cases are mistaken for the lids, and so removed, resulting in double work. All these mistakes can be easily avoided by a little care, and both time and expense saved. When consigning honey by rail the consignment-note should be marked "N.Z. Extracted Honey—Locally produced." This will ensure it being accepted at a cheaper rate than ordinary goods.

LATE FEEDING.

Feeding in the autumn is always a matter that requires special care, as at such times there is a grave danger of setting up robbing in the apiary. Perhaps the safest method is to feed only strong colonies, and then in the evening, supplying plenty of empty combs in which to store the syrup, which should be given rapidly or as fast as the bees can take it up. Weaker colonies may then be supplied with frames of stores from these strong colonies, but in transferring frames care must at all times be taken to see that no disease is present. By adopting this method the danger of robbing is greatly reduced.

It is now almost impossible to obtain white sugar, but beekeepers are being supplied with No. 3 grade, which is a light-brown sugar. This will be found to be fairly safe where bees are enabled to have an occasional cleansing flight. There may, however, be a risk in using it for winter stores in the colder portion of the South Island, where for two or three months in the year the bees have no opportunity of leaving their hives. Arrangements have been made by the controlling authority whereby the New Zealand Honey Producers' Association will supply all beekeepers requiring sugar for feeding purposes, whether such beekeepers are members of the association or not.

VITICULTURE.

S. F. ANDERSON, Vine and Wine Instructor.

WINEMAKING OPERATIONS.

LAST month's notes brought the vintage operations up to the stage of getting the newly made wine into the casks. Although, as already mentioned, wine is made good or bad by the methods used and cleanliness observed at that particular stage, the wine cannot be considered safe so long as it is in contact with the lees. After the second fermentation is quite over, and the wine still, the lees, under the

influence of rest and a cool temperature, are deposited at the bottom of the cask. This is the time for the first racking. The settlement of the lees, although influenced more or less by the weather, is fairly rapid with our light New Zealand wines, the time being from two to three weeks. The sooner after settlement they are drawn off the better, as they contain cells of yeast and other germs which, with a rise of temperature, become harmful to the wine.

The state of the weather when this racking is done is an important factor. It should be clear, bright, cool, and quiet. The casks racked into should be sulphured, and the wine pumped into them with as little contact with the air as possible. Wine loses alcohol every time it is racked, but the cooler the weather and more expeditious the transfer the less is that loss. Where the grapes have been well ripened and are in good condition generally the wine may be tolerably clear. A second or even a third racking will be required before it attains its best condition. The intervals between these rackings depend on local conditions, but should be completed before spring, because on the approach of that season nearly all wine moves more or less—that is, a slight fermentation takes place. During that time all transferring of wine from one vessel to another or bottling should be held over. On the wine regaining its proper clear condition it is generally found to be improved. This spring movement is greatest in the new and least in the old wines. The final racking of the new wines is transferring the wine to the casks in the cellar to mature. Subsequent racking may be required, but these are done in the cellar from time to time after fining, &c.

Saving the Lees.—Where the quantity of lees is considerable they should be stored. They will keep an indefinite time when properly casked. Their value consists in the amount of cream of tartar they contain. Fifty gallons of freshly made wine will deposit at least a gallon of lees. Four-fifths of this will be wine, the remaining one-fifth solid sediment containing the cream of tartar. Although there is not at present a sale for this solid sediment, the high price for cream of tartar may make the venture of storing worth while.

The method of saving the lees is as follows: A cask is selected of a size estimated to contain the solid portion after drawing off the wine. Where, say, the vintage has yielded 3,000 gallons, the resulting solid portion of the lees would be approximately 48 gallons. In such a case an ordinary wine-hogshead stood on its end would serve. A hole large enough to admit a good-sized funnel is bored in the head for introducing the lees, then other smaller holes at intervals of, say, 9 in. from bottom to top of the cask. Filling the cask is done at intervals. After putting in each lot a piece of sulphur wick is burned, and the hole closed until the next lot is added. This is repeated with each addition to the contents when some days elapse between the fillings. As the lees settle the wine is drawn off at the smaller holes, the other part settling in a solid mass as the operation goes on. These lees can accumulate till a sufficient quantity is obtained for further dealing with and preparation for market. This consists in drying and bagging up the material.

The wine drawn off from the lees is harsh and not fit to be added to the other wines, nor is it fit for the still. It should be kept by itself to mellow by age.

THE VINES UNDER GLASS.

Excepting the late grapes, such as Gros Maroc, Gros Colman, Pearson's Golden Queen, and Lady Downes, most of the vinehouses are now cleared of their fruit. In many cases these late grapes are rushed on to the market before they are fit, in order to save them from spoiling, because of mealy bug, mildew, drip from leaky roofs, and other causes, often brought about by careless methods. It should be realized when growing plants under glass that the plants are much more dependent on the grower than those living in open air. The houses must be kept in repair, and daily attention given to control of growth, suppression of insect pests, cultivation, &c. Lack of steady and timely attention always results in the vinehouse getting into a condition that gives very greatly increased after-trouble.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

GARDEN-WORK at the present time consists mostly in attention to growing crops.

Spinach should be thinned to single plants standing 8 to 10 in. apart. The object is to produce strong individual plants, as the leaves are gathered separately, and the larger they are the more succulent they will be. If growth is not satisfactory give a dressing of nitrate of soda, $\frac{3}{4}$ oz. per square yard. Keep the surface soil loose by light hoeing.

Turnips intended to stand for late use should be thinned to about 4 in. apart. Those intended for pulling early need very little thinning of the young plants. It can be done by drawing the roots as they become large enough for use, thus obtaining a very large yield.

Cabbages, broccoli, &c., should be moulded up as soon as they have made sufficient growth. Moulding up should be done in a way that will cover weeds growing between the plants as well as those between the rows. The growth of the plants should then cover the ground and practically prevent further growth of weeds.

Celery may be all moulded up now, but this should not be done while the soil about the roots is dry, as after moulding up water cannot reach most of the roots, and the result would be pithy stems. If possible, the trenches should be given a thorough soaking of water. If this is not practicable delay moulding-up till after a heavy fall of rain. The way the moulding-up is done is of considerable importance if the heads are well grown. The soil should be packed very firmly about the lower part of the heads, so as to prevent the stems bulging or bending, which the weight of soil will cause unless it is well packed at the base. There are various methods employed in blanching, such as the use of cardboard collars, strips of strong paper, &c., in which the heads are enveloped before the earth is packed around them. These methods are not necessary for ordinary purposes. It is important, however, to prevent the soil getting to the hearts. This is done by

first tying the heads together with a strand of green flax or rafia, or by making a two-handed job of it, when a man or boy holds the heads together while another throws in the soil. The person holding the heads also uses his hand to pack the soil firm, and this is the most expeditious method. In places where slugs or wireworms are troublesome a good dusting of a mixture of lime and soot should be given an hour or two before beginning to mould up.

Leeks should be sufficiently advanced for moulding-up. Some people still adhere to the old-fashioned way of growing leeks in trenches, an expensive method that has been abandoned by most growers. If in trenches, moulding-up simply consists in filling the trenches. When grown by the method described in former notes there are no trenches. The plants are set deep, and a considerable portion is blanched naturally. An additional length can be blanched by drawing soil up round the plants, the best results being secured by first wrapping each plant round with a strip of newspaper cut about 6 in. wide and secured with a tie of rafia, soil being then drawn up as high as possible.

The sowing of cauliflower, cabbage, onion, and lettuce was advised for the last week in March or the first week in April. Two varieties of cauliflower were advised, an early and a giant kind. Early cauliflowers are very prone to form heads prematurely, when, of course, they are useless. A little extra care can eliminate this bad habit. As soon as the seedlings are large enough to handle they should be pricked off into a plot of good soil, spacing them about 3 in. apart. The pricking-off will cause them to form an extra large number of roots, and tends to promote a future stronger growth than is possible with plants not so treated. This extra shift, though it is an advantage, is not really important for the larger variety, nor for cabbages.

Asparagus.—When the tops are dead, or nearly so, they should be cut down close to the surface of the soil, rather below than above, because the dead tops become hollow, and unless they are covered with soil they afford harbours for woodlice and other vermin. When the tops are cleared off the surface soil may be lightly broken up. Further treatment, manuring, &c., will be dealt with in next month's notes. Any one intending to plant asparagus next spring should select a site for the plantation at once and get it cleared of weeds, particularly any with perennial roots. It is not now the custom to expend a large amount of labour and material in the preparation of beds, clean soil of fair depth and moderately well manured is all that is required. The culture of asparagus is not yet so general as it should be. This is due partly to the reluctance some people have to plant anything that is not immediately productive, and partly to the erroneous idea that it is an expensive crop to grow. The latter idea is quite wrong; it is, in fact, one of the cheapest crops. The only bar to its general adoption is the fact that it occupies the ground permanently and produces but one crop each year. This prevents those with only small cottage-gardens indulging in it, but is no bar where the area is such that a square rod or two can easily be spared. The advantages are that with modern methods it costs little to establish and once established it requires very little attention, and every year it automatically supplies liberal gatherings of the finest of all vegetables at a time when other supplies are always short. It is, in fact, the greatest asset of any vegetable-garden, and no good garden should be without it.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

COW WITH INFLAMMATION OF HEAD-PASSAGES.

H. S. S., Kaipara :—

I have a five-year-old cow which was dehorned in her second year. Last winter I noticed that her breathing was affected, and for the last three months there has been a discharge coming periodically from the stump of one of the horns. This discharge bubbles in sympathy with her breathing, which is very harsh. The inside of the horn appears to be in a diseased state. I shall be glad if you can give me advice as to treatment.

The Live-stock Division :—

The trouble is caused by inflammation extending from the horn-cone to the various sinuses of the head, and also to the lining of the nostrils. This inflammation is accompanied by suppuration, which fills the sinuses with pus, hence the symptoms you describe. It is best treated by opening the cavities where the pus has collected and allowing it to escape; but, as this would require a major operation and the wound to be washed and dressed for weeks afterwards, it is doubtful if the animal is worth the trouble. The animal might be fattened and sold for beef, if otherwise healthy. The carcase, with the exception of the head, would be fit for human consumption.

CHEMICAL TREATMENT OF TREE-STUMPS.

" GLENDYNE," Waimamaku :—

Please advise me as to the procedure for dissolving large stumps and kauri leads with sulphuric and nitric acids, and if this is an expensive way of getting rid of the timber. My section is an old kauri working on which there are a good number of stumps. I have been told that after they go to powder after this treatment the residue makes valuable manure.

The Fields Instruction Branch :—

We would suggest as an alternative treatment the use of nitre (potassium nitrate), as sulphuric acid is now quoted at £22 a ton, and nitric acid, which is difficult to procure at the present time, is much more expensive. Bore a number of two-inch holes into the stumps at a depth of about 6 in. and plug them with nitre. After a week the whole stump may be fired, and the residual ash will remain as a fertilizer. The nitre disseminates through the stump and will cause it to burn readily.

ARSENITE-OF-LIME SPRAY.—LEAF-HOPPER PEST.

F. A. THORNE, Woolston :—

Could you give me some information about arsenite of calcium? Can we prepare it ourselves, and are the ingredients obtainable here at a reasonable figure? I also desire some advice regarding leaf-hopper, which is very prevalent in this district this season.

The Horticulture Division :—

Arsenite of lime (calcium arsenite) is being increasingly used in America. This compound is more burning than arsenate of lead, but it is much cheaper and

appears to be safe on pip-fruits. Warnings have been issued by American authorities against its use on any stone-fruit. Probably a way may be found to render it suitable for all purposes for which arsenate of lead is used. The following is extracted from an American bulletin: "Arsenite of Lime—White arsenic 1 lb., lime 2 lb., water 3 gallons. Boil together for fully forty minutes after boiling-point is reached. As a precaution against burning, slake 2 or 3 additional pounds of lime. Put the milk in 3 or 4 gallons of water and add to the boiling mixture. Strain and dilute to from 200 to 250 gallons for hardy vegetation, such as potatoes. Do not use at all on stone-fruits or on cucurbits. Dilute to 300 or 400 gallons for tender vegetation. It is safer when used in bordeaux mixture."

Leaf-hopper is prevalent throughout the Christchurch district. It was the subject of close observation this year at the Papanui Experimental Orchard, where it was very numerous the previous season. Here the result of the season's operations has been very successful; the fruit-set and subsequent lime-sulphur sprays, at 1-100, kept the pest well under control. The early sprays are the most important, as it is essential that the insect be destroyed in the nymph stage. Once it is winged it is very difficult to reach with the spray.

POTATOES AS PIG FOOD.

A. J. HARRISON, Waikiekie :—

Will you kindly let me know if raw potatoes do pigs any harm.

The Live-stock Division :—

No harm should result from the feeding of raw potatoes to pigs if the potatoes are combined with other foods; but if the pigs are fed solely on a potato diet some harm may occur, as there is reason to believe that raw potatoes contain some poisonous element, which is lost by steaming or boiling. In numerous experiments it has been found that pigs secure better flesh gains by being fed on cooked potatoes compared with those given raw. Potatoes appear to agree with pigs better than any root crops, particularly when the ration is balanced with barley, maize, or skim-milk. Roots (turnips, &c.) should be fed uncooked.

GRASS-GRUB AND WHEAT.

T. J. S. DOHERTY, Methven :—

I would like a little advice on the advisability of growing wheat in a paddock which while in grass this summer has been greatly infested with grub. Will the grub take the wheat when it comes up, as they did the grass, (1) if I sow in May and June, and (2) if I sow in August?

The Fields Instruction Branch :—

If you were to sow wheat this autumn on the land and under the conditions described by you there would be a decided risk of the grass-grub taking the wheat. It would be much safer to sow spring wheat in August, but the grass-grub might even then do a certain amount of damage. This, of course, would depend on what stage the grubs in your land had reached in their life-cycle of development.

An unsigned inquiry from Appleby, regarding cow's milk, cannot be answered unless name is furnished.

FORTHCOMING WINTER SHOWS.

Clutha Valley A. and P. Society: Greenfield, 5th May.

Otago A. and P. Society: 1st to 4th June.

Manawatu and West Coast A. and P. Association: Palmerston North, 22nd to 25th June.

(A. and P. Association secretaries are invited to supply dates and location of their shows.)

REGULATIONS GOVERNING SALE OF NEW-ZEALAND-GROWN FRUIT FOR LOCAL CONSUMPTION.

THE following regulations, relating to the sale of New-Zealand-grown fruit of specified kinds for consumption within the Dominion, have been made under the Orchard and Garden Diseases Act, and came into force on 15th April, the date of their gazetting :—

DEFINITIONS.

1. In these regulations, if not inconsistent with the context,—

"Blemish" includes branch-rubs, scratches, insect-bites, unnatural russetting, bruises, excrescences, sun-scalds, hail-marks, or any other injury detrimental to the appearance of fruit, but does not include spray injury or damage by leaf-roller caterpillar.

"Brand" means to stencil or imprint clearly and legibly.

"Clean" means free from dirt, insect-stains, and spray-stains.

"Director" means the Director of the Horticulture Division of the Department of Agriculture.

"Mature" means having the degree of ripeness suitable for marketing.

"Owner" means any owner, shipper, or consignor of fruit, and includes the agent or servant of any such owner, shipper, or consignor, and also includes, in the case of a company, the managing director, manager, director, secretary, or other principal officer of the company in New Zealand.

"Pack" means to regularly and compactly arrange fruit in a package.

"Package" means any form of container having a capacity of not less than 55½ cubic inches or one-fourth of an Imperial bushel, and includes a container consisting of any number of smaller containers held together by some means to form one.

"Sell" means to exchange for money or barter, and includes offering or exposing for sale, or sending or delivering for sale, or allowing to be sold or offered or exposed for sale.

"Size" when used as a noun means the diameter of fruit measured from cheek to cheek at the widest part, and when used as a verb means to sort according to size.

"Solid red varieties" means any of the varieties of apples included in Section 1 of the Schedule hereto, and any other varieties having a similar colouring.

"Spray injury" means the russetting of, or other injury to, fruit as a result of spraying.

"Striped or partial red varieties" means any of the varieties of apples included in Section 2 of the Schedule hereto, and any other varieties having similar colouring.

"Yellow or green varieties" means any of the varieties of apples included in Section 3 of the Schedule hereto, and any other varieties having similar colouring.

PACKAGES FOR FRUIT.

2. This part of these regulations shall apply only to apples, pears, quinces, lemons, oranges, peaches, nectarines, and plums.

3. No fruit of any of the kinds enumerated in Regulation 2 above shall be sold in packages except such packages conform to one or other of the types of packages hereinafter prescribed for the several kinds of fruit :

Provided that nothing in this part of these regulations shall apply to fruit of the above-mentioned kinds which is sold direct to a factory or works for the purpose of being utilized in the manufacture of any product, or is sold direct to a packing establishment to be there packed.

4. (1.) The packages in which apples, pears, quinces, lemons, or oranges may be sold shall be of one or other of the following types :—

(a.) A wooden case having an inside measurement of 10 in. by 11½ in. by 19½ in.

(b.) A wooden case having an inside measurement of 5 in. by 11½ in. by 19½ in.

(c.) A wooden case having an inside measurement of 7 in. by 8 in. by 19½ in.

(d.) A wooden case having an inside measurement of 5 in. by $11\frac{1}{4}$ in. by $9\frac{7}{8}$ in.

(e.) A package of three wooden trays strapped together, one above the other, each tray having an inside measurement of $11\frac{1}{4}$ in. by $19\frac{3}{4}$ in., with a depth unspecified but not greater than is necessary to take one layer of the kind of fruit being packed. The straps shall be of wood $\frac{3}{8}$ in. thick and $1\frac{1}{2}$ in. wide, secured to the ends of the trays, two straps to each end, and flush with the sides of the package thus formed.

(f.) A wooden crate of any size containing wooden cases having an inside measurement of 5 in. by $11\frac{1}{4}$ in. by $9\frac{7}{8}$ in.

(2.) Packages of the types described in subparagraphs (a), (b), (c), and (e) of paragraph (1) of this regulation shall be constructed of timber $\frac{3}{4}$ in. thick for the ends and $\frac{1}{8}$ in. thick for the sides, tops, and bottoms.

(3.) Packages of the type described in subparagraph (d) of paragraph (1) of this regulation shall be constructed of timber $\frac{1}{2}$ in. thick for the ends and $\frac{1}{4}$ in. thick for the sides, tops, and bottoms.

5. (1.) The packages in which peaches, nectarines, or plums may be sold shall be of one or other of the following types :—

(a.) A wooden case having an inside measurement of 5 in. by $11\frac{1}{4}$ in. by $19\frac{3}{4}$ in., with a partition $\frac{1}{2}$ in. thick in the centre if desired.

(b.) A wooden case having an inside measurement of 7 in. by 8 in. by $19\frac{3}{4}$ in., with a partition $\frac{1}{2}$ in. thick in the centre if desired.

(c.) A wooden case having an inside measurement of 6 in. by 7 in. by 28 in., with a partition $\frac{1}{2}$ in. thick in the centre.

(d.) A wooden case having an inside measurement of 5 in. by $11\frac{1}{4}$ in. by $9\frac{7}{8}$ in.

(e.) A package of three wooden trays strapped together, one above the other, each tray having an inside measurement of $11\frac{1}{4}$ in. by $19\frac{3}{4}$ in., with a depth unspecified but not greater than is necessary to take one layer of the kind of fruit being packed. The straps shall be of wood, $\frac{3}{8}$ in. thick and $1\frac{1}{2}$ in. wide, secured to the ends of the trays, two straps to each end, and flush with the sides of the package thus formed.

(f.) A wooden crate of any size containing wooden cases having an inside measurement of 5 in. by $11\frac{1}{4}$ in. by $9\frac{7}{8}$ in.

(g.) A wooden crate of any size containing any number of punnets.

(2.) Packages of the types described in subparagraphs (a), (b), (c), and (e) of paragraph (1) of this regulation shall be constructed of timber $\frac{3}{4}$ in. thick for the ends and $\frac{1}{8}$ in. thick for the sides, tops, and bottoms.

(3.) Packages of the type described in subparagraph (d) of paragraph (1) of this regulation shall be constructed of timber $\frac{1}{2}$ in. thick for the ends and $\frac{1}{4}$ in. thick for the sides, tops, and bottoms.

6. If any person, at the coming into force of these regulations, has on hand any packages of a different type from those herein specified, or stocks of timber specially sawn for making such packages, he may, on obtaining permission from the Director to do so, use such packages in packing for sale fruit of the kinds referred to in this part of these regulations :

Provided that such permission shall authorize the use of such packages as aforesaid only up to and including the 31st October, 1920.

MARKING OF PACKAGES WITH REGISTERED NUMBER.

7. This part of these regulations shall apply only to apples, pears, quinces, peaches, nectarines, plums, apricots, cherries, oranges, and lemons.

8. Every package of fruit of any of the kinds mentioned in the preceding regulation sold or offered for sale shall be branded with the registered number of the owner of such fruit, allotted as hereinafter prescribed.

9. Every owner of fruit of the kinds set out in this part of these regulations who sells such fruit in packages shall apply to the Director for registration :

Provided that every occupier of an orchard from which fruit is sold or intended to be sold, to whom, at the coming into operation of these regulations, a certificate of registration of such orchard has been issued in terms of the regulations dated the 3rd September, 1917, and published in the *Gazette* of 6th idem, shall be deemed to have applied for registration under these regulations, and a certificate of registration and a registered number shall be issued to him as hereinafter prescribed.

10. The Director on receipt of such application shall without fee register such owner of fruit, allotting to him a registered number, and shall issue to such owner a certificate of registration accordingly.

11. Such registered number may consist of any combination of letters and numerals.

12. No registered number shall be transferred without the consent in writing of the Director.

13. If a registered number has not been used for a period of two years the Director may, after giving one month's notice in writing, cancel the registration of the owner of such registered number, which will then be available for reallocation.

14. The owner of fruit for sale shall brand his registered number in characters of 1 in. block type on one end of each package of such fruit if such package is a fruit-case, or, if not, in some prominent position thereon.

15. No auctioneer or other selling agent shall sell or offer for sale any fruit of the kinds set out in this part of these regulations contained in packages which are not branded with a registered number.

16. No owner shall sell fruit of any of the kinds set out in this part of these regulations in packages which bear any other than his own registered number, and he shall erase or obliterate any other registered number on such packages:

Provided that in the event of the purchaser of any fruit selling the same without removing such fruit or any portion of it from the packages for any purpose, including the repacking of it in the same packages, he shall sell such fruit under the registered number already branded on the packages, without alteration or addition thereto.

17. Nothing in these regulations shall prevent the holder of a registered number using any other design or mark in combination with such registered number for the purpose of marking his packages of fruit, provided the requirements of these regulations in regard to the use of such registered numbers are complied with.

SALE OF FRUIT UNDER OFFICIAL GRADE-MARKS.

18. The following are the official grades in which apples or pears may be classed: Extra Fancy, Fancy, C Grade; and the words "Extra Fancy," "Fancy," and "C Grade" shall be deemed to be and shall be known as official grade-marks.

19. (1.) No apples or pears shall be sold in packages bearing thereon any of the above official grade-marks unless such apples or pears conform to the standards hereinafter set out for the corresponding grades, and unless all the requirements of this part of these regulations are complied with.

(2.) The official grade-marks shall not be applied to fruit other than apples and pears unless and until such fruit is brought within the scope of this part of these regulations.

Apples.

20. The following are the standards by which the grade of apples shall be determined:—

(a.) *Extra Fancy Grade.*—Apples of this grade shall be of not less size than $2\frac{1}{4}$ in., sound, smooth, and clean. They shall be mature, well formed, hand-picked, true to name, and free from disease, spray injury, visible bitter-pit, skin-puncture or skin broken at stem, and other defects. Very slightly blemished apples may be included in this grade, provided that not more than 8 per cent. of the total number in any one package are so blemished. The individual apples of solid red and striped or partial red varieties shall carry not less than 75 per cent. and 50 per cent. respectively of good typical colour. The individual apples of yellow or green varieties shall be of good characteristic colour.

(b.) *Fancy Grade.*—Apples of this grade shall be of not less size than $2\frac{1}{4}$ in., sound, smooth, and clean. They shall be mature, well formed, hand-picked, true to name, and free from disease, visible bitter-pit, skin-puncture or skin broken at stem, and other defects. Slightly blemished apples may be included in this grade, provided that no individual apple shall have more than 5 per cent. of its surface affected thereby. Apples affected by spray injury may also be included in this grade, provided that no individual apple shall have more than 5 per cent. of its surface affected thereby. The individual apples of solid red and striped or partial red varieties shall carry not less than 50 per cent. and 25 per cent. respectively of good typical colour. The individual apples of yellow or green varieties shall be of good characteristic colour.

(c.) *C Grade.*—Apples of this grade shall be of not less size than $2\frac{1}{4}$ in., moderately clean, sound, mature, true to name, free from disease and visible bitter-pit. Blemished apples may be included in this grade, provided that no individual apple shall have more than 10 per cent. of its surface affected by blemish. Apples affected by spray injury may also be included in this grade, but no individual apple shall be distorted thereby. Apples damaged by leaf-roller caterpillar to the extent of 10 per cent. of their surface may be included, provided that the keeping-qualities of the apples so damaged are not impaired.

Pears.

21. The following are the standards by which the grade of pears shall be determined :—

(a.) *Extra Fancy Grade.*—Pears of this grade shall be of not less size than 2 in. if pyriform in shape and $2\frac{1}{2}$ in. if round in shape. They shall be clean, sound, clear-skinned, and of bright appearance. They shall be mature, well formed, hand-picked, true to name, and free from disease, spray injury, skin-puncture or skin broken at stem, and other defects. Very slightly blemished pears may be included in this grade, provided that not more than 8 per cent. of the total number in any one package are so blemished.

(b.) *Fancy Grade.*—Pears of this grade shall be of not less size than 2 in. if pyriform in shape and $2\frac{1}{2}$ in. if round in shape. They shall be clean, sound, mature, well formed, hand-picked, true to name, and free from disease, skin-puncture or skin broken at stem, and other defects. Slightly blemished pears may be included in this grade, provided that no individual pear shall have more than 5 per cent. of its surface affected thereby. Pears affected by spray injury may be included in this grade, provided that no individual pear shall have more than 20 per cent. of its surface affected thereby. Pears having characteristic russetting shall not be deemed to be unfit for inclusion in this grade.

(c.) *C Grade.*—Pears of this grade shall be sound, moderately clean, true to name, and free from disease. No individual pear shall be included in this grade which has more than 15 per cent. of its surface affected by blemish.

Packing of Graded Fruit.

22. Prior to being placed in packages the graded apples or pears shall be sized, and only fruit of as nearly as possible the same size shall be packed together in a package.

23. In sizing apples or pears in any particular size for the purposes of packing a variation of not more than $\frac{1}{4}$ in. above the size in question will be allowed, but no apple or pear shall be included in a package which is of less size than that hereinafter required to be branded on such package.

24. Apples and pears of one grade only shall be packed in each package.

Provided that apples and pears of different grades may be contained in the same package if the official grade-mark to be placed on the package as hereinafter prescribed is that of the lowest grade of apples or pears contained in such package :

Provided further that nothing in this regulation shall be construed to authorize the packing of apples and pears or of different varieties of apples or of pears together in the one package.

25. Apples and pears of Extra Fancy, Fancy, and C Grades may be wrapped, but, if wrapped, new paper having one or both surfaces glazed or some other paper approved by the Director shall be used.

Branding Packages of Graded Fruit.

26. The following particulars shall be branded in characters of not less than $\frac{1}{4}$ in. and not more than $\frac{3}{4}$ in. block type on each package of apples or pears sold under any of the official grade-marks :—

(a.) The grade of the fruit as determined by the standards hereinbefore set out.

(b.) The name of the variety contained in the package. In the event of the variety not being known by the owner the words "Variety unknown" shall be branded on the package.

(c.) The size of the fruit contained in the package, determined as hereinbefore provided.

(d.) The number of fruit contained in the package.

(e.) If the fruit has been picked from trees that have not been planted out in the orchard for at least seven years, the letters "N.K.," signifying that the keeping-quality of such fruit is not reliable.

27. The particulars set out in the preceding regulation shall be branded on the same end of the package as the owner's registered number hereinbefore required by these regulations to be placed on one end of packages of fruit, and no other particulars shall be placed on that end except a design or mark used in conjunction with the registered number as hereinbefore authorized.

28. (1.) The particulars required by the last two preceding regulations to be branded on packages of fruit shall accurately describe the contents of such packages,

provided that a variation of not more than five per package shall be allowed in the number of fruit stated to be in such package.

(2.) If the contents of such packages are noticeably and to the detriment of a purchaser at variance with the particulars branded on such packages, the owner of such fruit shall be deemed to have committed a breach of these regulations.

General Provisions relating to Graded Fruit.

29. An Inspector may at any time examine any package of apples or pears bearing an official grade-mark, for the purpose of checking the grading of the contents thereof as indicated by the grade-mark on the package, and the correctness of the other particulars branded on the packages in accordance with the requirements of Regulation 26 above.

30. If on examination the Inspector is of opinion that the contents of any package of apples or pears are of a lower grade than that indicated by the grade-mark thereon, he shall erase such grade-mark, and shall place on the package a grade-mark indicating the grade which he allots to the contents of the package.

31. If such package is one of a line of apples or pears of the same variety and grade and belonging to the same owner, the grade allotted by the Inspector to the contents of such package shall be allotted to the whole line, and the grade-mark on the remaining packages of the line shall be altered accordingly:

Provided that before altering the grade of a line of apples or pears as aforesaid the Inspector shall examine the contents of at least 5 per cent. of the packages in the line.

32. If on examination the Inspector is of opinion that the contents of any package of apples or pears are of a lower standard than that prescribed for C Grade, he shall erase the grade-mark branded on the package, and no grade-mark shall be allowed thereon.

33. If the grade is altered by an Inspector as aforesaid, all work in connection with the examination of the packages of apples and pears for the purpose of determining the grade, and with the re-marking of packages, shall be done at the expense in all things of the owner of such apples and pears.

Sale of Apples and Pears under Official Grade-marks other than in Packages.

34. It shall not be lawful for the official grade-marks to be used to describe any apples or pears sold or offered for sale unless such apples or pears conform to the standards hereinbefore set out for the official grades.

35. Any apples or pears exposed in premises or places where fruit or produce is customarily sold which bear a label or other method of description in which any of the official grade-marks are employed shall be deemed to be offered for sale under the description of such official grade-mark.

PENALTIES.

36. Every person who commits a breach of any of these regulations shall be liable on conviction to a penalty not exceeding £20.

SCHEDULE.

SECTION 1.—SOLID RED VARIETIES OF APPLES.

Baldwin.	John Sharp.	Quarrenden.
Black Ben Davis.	King David.	Spitzenburg.
Black Prince.	McIntosh Red.	Tasma.
Hoover.	Rokewood.	

SECTION 2.—STRIPED OR PARTIAL RED VARIETIES OF APPLES.

Adams Pearmain.	Cellini.	Duchess of Oldenburg.
Alexander.	Charles Ross.	Duke of Clarence.
Allington Pippin.	Claygate Pearmain.	Edward Lippiatt.
American Horn.	Cliff's Seedling.	Frimley Beauty.
Annie Elizabeth.	Commerce.	Gravenstein.
Beauty of Bath.	Cornish Aromatic.	Irish Peach.
Ben Davis.	Cornish Gilliflower.	John Bull.
Black Twig.	Cox's Orange.	Jonathan.
Bramley's Seedling.	Crofton Pearmain.	Jubilee.
Buncombe.	Delicious.	Kentucky Red Streak.
Carolina Red June.	Dougherty.	Lady Hopetoun.

Lane's Prince Albert.	Ribston Pippin.	Shorland Queen.
McLiver's Winesap.	Rome Beauty.	Springdale.
New Rock Pippin.	Rymer.	Stansill.
Nickajack.	Salome.	Stark.
Northern Spy.	Scarlet Nonpareil.	Statesman.
Peasgood's Nonsuch.	Scarlet Pearmain.	Stayman Winesap.
Pomme de Neige.	Scarlet Queen.	Symond's Winter.
Premier.	Senator.	Worcester Pearmain.
Prince Alfred.	Sharp's Late Red.	Yates.
Red Astrakhan.	Shepherd's Perfection.	York Imperial.
Rhodes Orange.		

SECTION 3.—YELLOW OR GREEN VARIETIES OF APPLES.

Alfriston.	Gloria Mundi.	Pioneer.
Ballarat.	Granny Smith.	Reinette du Canada.
Blenheim Orange.	Hawthornden.	Rhode Island Greening.
Boston Russet.	Keswick Codlin.	Romanite.
Brownlee's Russet.	London Pippin.	Stone Pippin.
Cleopatra.	Lord Suffield.	Sturmer Pippin.
Colonial Washington.	Lord Wolseley.	Takapuna Russet.
Crisp's Russet.	Mobb's Royal.	Willie Sharp.
Dumelow's Seedling.	Newtown Pippin.	Warner's King.
Dunn's.	Nonpareil Russet.	Yellow Bellefleur.
Epps's Seedling.	Pigeonette.	Yellow Transparent.
French Crab.	Parlin's Beauty.	Winter Majetin.
Golden Pippin.		

FRUIT TRADE WITH NORTH AMERICA.

Mr. J. A. Campbell, Assistant Director of the Horticulture Division, reports as follows on this subject:—

"From my own observations and from information received I am of the opinion that a fairly good trade in apples and pears could be done both with British Columbia and the United States. It appears to be the unanimous opinion in official circles and among those engaged in the fruit trade that the demand for both apples and pears is in excess of the supply, and the high prices which these fruits were bringing last year in the height of the season goes to support this contention. The continually increasing demand for practically all classes of fruit in America has not been altogether due to the increasing population, but very largely to an increased consumption brought about by the co-operative movement, the stabilization of the commodity through the introduction of standard-packing laws, and extensive advertising, resulting in a continuously increasing field of distribution. The extensive cool-storage facilities in America, by which means a certain quantity of fruit is carried over every year, have to be taken into account, but in the face of the present high prices the general opinion is that this is not likely to seriously affect the position. However favourable the prospect of a fruit trade with North America may appear, it will be very inadvisable to enter upon it unless every attempt is made to reach the high standard of perfection in our grading and packing which obtains there. Further, with reference to British Columbia, the fact must be fully appreciated that, owing to the stringency of the quarantine laws, loss is practically certain to result from the shipment of fruit which is not absolutely free from disease, particularly codlin-moth."

State Forestry.—Referring to the review of the State Forestry Report of 1918-19, published in last month's *Journal*, due recognition must be given to the recording of many valuable data in past years by the late Forestry Branch of the Lands Department. Specific mention may be made of a comprehensive return of forest areas owned by the State, printed in the publication "Forestry in New Zealand," issued by the Lands Department in 1909:

SALE AND PURCHASE OF WHEAT.

REGULATIONS governing the sale and purchase of wheat were gazetted on 20th March. The system of Government control is continued on similar lines generally to those of the two previous years. Brokers will buy good milling-wheat of the current season at the following prices:—

A. Grown in the South Island elsewhere than in the Provincial Districts of Nelson and Marlborough:—

(1.) Sold for delivery free on board at the nearest port—

In January, February, March, or April, 1920, 7s. 3d. per bushel for Tuscan, 7s. 6d. per bushel for Hunters, 7s. 9d. per bushel for Pearl.

In May, 7s. 3½d. for Tuscan, 7s. 6½d. for Hunters, 7s. 9½d. for Pearl.

In June, 7s. 4d. for Tuscan, 7s. 7d. for Hunters, 7s. 10d. for Pearl.

In July, 7s. 4½d. for Tuscan, 7s. 7½d. for Hunters, 7s. 10½d. for Pearl.

In August, 7s. 5d. for Tuscan, 7s. 8d. for Hunters, 7s. 11d. for Pearl.

In September, 7s. 5½d. for Tuscan, 7s. 8½d. for Hunters, 7s. 11½d. for Pearl.

In or after October, 7s. 6d. for Tuscan, 7s. 9d. for Hunters, 8s. for Pearl.

(2.) Sold for delivery otherwise than free on board at the nearest port—A price equivalent as regards the seller to the prices aforesaid.

B. Grown in the North Island or in the Provincial District of Nelson or Marlborough:—

(1.) Sold for delivery free on rail at the nearest railway-station—The same price as that fixed for good milling-wheat grown in the South Island (elsewhere than in Nelson or Marlborough) and sold for delivery free on board at the nearest port, with an addition of 4d. per bushel.

(2.) Sold for delivery otherwise than free on rail at the nearest railway-station—A price equivalent as regards the seller to the price aforesaid.

Sacks will be paid for, in addition to the above prices, at the fair market value, not exceeding 2s. 4d. for 48 in. sacks and 2s. 3d. for 46 in. sacks.

The varieties of wheat recognized under the regulations are defined as follows: "Tuscan" includes all varieties of Tuscan, also Talavera, Dreadnought, Red Marvel, Federation, Yandalla King, and John Brown; also all varieties not classed as Hunters or Pearl herein. "Hunters" includes all varieties of Hunters, also Victor, McCallum's, Webb's Challenge, Webb's Standup White, Bordier, Velvetear, Sensation, and Redchaff. "Pearl" includes Pearl, Velvet, and Bobs.

The maximum selling-price of seed-wheat is again 5d. per bushel higher than that of the millers' price for good milling-wheat, and machine-dressed seed is allowed a further addition of 5d. per bushel. A wheat-grower may sell directly to any other grower wheat in quantity not aggregating more than 100 bushels for use as seed by the purchaser.

Fowl-wheat.

In an Order in Council accompanying the regulations the price of this class of wheat is fixed as follows:—

The maximum price of free wheat inferior in quality to good milling-wheat, when sold by the grower, shall be a price equivalent as regards the grower to the Government price of Tuscan wheat for the same month of delivery, less 2d. per bushel.

The maximum price of free wheat inferior in quality to good milling-wheat, when sold wholesale by millers, brokers, or other purchasers from the growers free on board or rail at the nearest port or railway-station on the usual trade terms as established at the date of this Order in Council, shall be the Government price for good milling-wheat of Tuscan variety, delivered free on board or rail at the nearest port or railway-station in the same month, less 1d. per bushel. When sold otherwise than free on board or rail at the nearest port or railway-station on the said trade terms, the maximum price shall be a price equivalent as regards the seller to the maximum price aforesaid.

The maximum price of wheat inferior in quality to good milling-wheat when sold retail for delivery in any month by any person other than the grower shall be the same as the price lawfully payable for similar wheat of Tuscan variety when sold wholesale by millers, brokers, or other purchasers from the growers for

delivery in the same month free on board at Lyttelton on the usual trade terms, with the following additions only to such lawful price—namely, an addition of 15 per cent., together with a further addition of the transit charges actually paid by the retail seller of such wheat.

THE ENSUING YEAR'S WHEAT CROP.

DEALING with the wheat question in a public statement made last month, the Hon. W. Nosworthy, Minister of Agriculture, concluded a reference to next year's position as follows—

"I have recently learned that some doubt exists in the minds of many farmers as to the price to be paid for the ensuing year's crop—1920-21. In order to make the position perfectly clear I may say that at the conference I had recently with the growers it was unanimously decided to accept the offer I made on behalf of the Government—namely, 7s. 3d. for Tuscan, 7s. 6d. for Hunters, and 7s. 9d. for Pearl, these to be minimum f.o.b. prices. The point which some farmers appear to be in doubt over is the word 'minimum.' These prices are guaranteed minimum f.o.b. prices, which will be adjusted according to market rates ruling at the time. In addition there is the increment of 3d. per month per bushel for six months on and after 1st May to cover storage, which is an increase of 4d. over the rate to be paid this season. The question of cost of production has been carefully and exhaustively inquired into by various officers of my Department, and it was on the basis of these investigations that the offers accepted for this and next year's crop were made. On behalf of the Government I wish to make a very strong appeal to farmers to grow as much wheat as they possible can this year in order that sufficient may be produced for the Dominion's requirements, and thus avoid the necessity of going to Australia or elsewhere for supplies. I trust that farmers, when they realize the position, will respond to the appeal of the Government. To my mind, it is a very serious state of things when a young country such as this is unable to satisfy its own wants as far as wheat is concerned."

FARM TRAINING FOR DEMOBILIZED BRITISH OFFICERS.

THE Director-General of Agriculture (Dr. C. J. Reakes) has issued the following statement regarding a scheme for the training in farming operations in this country of British officers who may wish to have such a training:—

"Following the termination of the war, the Imperial Government has adopted a policy of encouraging demobilized officers of a suitable type to take up farming as an occupation in the overseas Dominions. An arrangement has been made under which fifty selected fit men who have held commissions in the Imperial Forces are given some monetary assistance by the Home Government towards learning farming occupations in New Zealand. Later, some who are partially disabled may come along. It is expected that the fit men may begin to arrive at any time, and it is consequently necessary to now make provision for assisting them to settle down and begin to learn farming under New Zealand conditions. The arrangement made by the Home Government provides that they may go through a course at an agricultural college, learn the work on a Government farm, or on a privately owned station or farm approved by the New Zealand Department of Agriculture. At the present time all the available accommodation at the Government farms is occupied by our own returned soldiers, and will be kept available for them as long as is needed, hence it is desired that places be found on sheep-stations or suitable privately owned farms for those incoming learners who decide to learn farming on purely practical lines rather than take a course in scientific agriculture. They should make good settlers later, and thereby do their share in increasing the productivity of the Dominion. It can be quite well assumed that, being learners, they will be willing to enter into suitable financial arrangements with those willing to take them on. I shall be very glad if any station-owner or farmer who would be agreeable to assist in this particular phase of post-war reconstruction work by taking one of these soldier learners on to his place will communicate with me as soon as possible, stating what he is prepared to do. From what little I know I anticipate that they will be prepared to get right into work and do their best, and not look for anything more than the decent and cleanly living-conditions fully deserved by men who have risked their lives for their country, and thereby earned consideration and assistance from their kinsmen overseas."

BOARD OF AGRICULTURE.

THE appointment of the following members of the Board of Agriculture, as from 30th April, 1920, has been gazetted: Sir J. G. Wilson, Messrs. J. C. N. Grigg, E. Hall, and W. Perry (Government nominees), E. Averill (Hawke's Bay), W. B. Grant (Taranaki), D. Marshall (Southland), J. Massey (Auckland), W. R. May (Nelson, Marlborough, and West Coast), A. S. Orbell (Otago), J. H. Perrett (Manawatu), and D. W. Westenra (Canterbury). Sir J. G. Wilson has been named as President and Mr. Grigg as Vice-President of the Board.

SOUTHERN PASTORAL LANDS COMMISSION.

A ROYAL Commission has been appointed to inquire into the questions whether the pastoral Crown lands of the land districts of Canterbury, Otago, and Southland are being leased and utilized in the best manner, and whether the pasturage is deteriorating, and, if so, the cause of such deterioration, and how best to remedy the same and to improve the conditions of settlement of the said lands. The personnel of the Commission is as follows: Messrs. Robert Thomas Sadd (Commissioner of Crown Lands and Chief Surveyor for the Otago Land District), William Blyth Buckhurst (Land Valuer, Christchurch), Dr. Leonard Cockayne (Wellington), and Messrs. Dickson Jardine (pastoralist, of Birchwood, Southland), Robert Scott (farmer, of Kyeburn, Otago), Archibald McInnes (farmer, of Otiake, Otago), and Charles Todd (merchant, Dunedin). Mr. Sadd is to be chairman of the Commission.

LAND FOR RETURNED SOLDIERS.

AN area of 65,300 acres of land, subdivided into eighty-four holdings, was opened for selection by returned soldiers during March. Two pastoral runs in Canterbury were included of an aggregate area of 40,000 acres suitable for grazing, twenty-four holdings of a total area of 3,528 acres suitable for general agricultural purposes, and the remainder was principally mixed farming and dairying land.

During the present month approximately 28,000 acres will be available, subdivided into seventy-six farms, and in addition a small grazing-run of 7,100 acres in Otago will also be put on the market.

Early in May the Tukurumuri Settlement, situated in the Wairarapa district, recently acquired from Mr. V. Riddiford, and comprising an area of 6,162 acres of grazing-country, will be offered by ballot. This settlement has been subdivided into eleven holdings, the areas of which vary from 300 to 900 acres.

The following settlements will also be offered during the next month: Marlborough—Moorlands Settlement, 953 acres, subdivided into six farms; Canterbury—Springwell, 780 acres, subdivided into six sections; and Otago—Wairuna and Tilverstowe Settlements, of a total area of 18,800 acres, comprising twenty sections. In addition two large grazing-runs will be offered in the Otago District.

Large areas of Crown lands are under survey, but although at present it is not possible to fix a date for their opening they will be offered from time to time. The Surveyors are now surveying 156,673 acres in the Auckland Land District alone.

Threshings of Wheat and Oats.—Returns of actual threshings received from threshing-mill owners by the Government Statistician up to 19th April showed that till then 1,048,313 bushels of wheat and 1,844,881 bushels of oats had been threshed out. The average yield per acre in cases where particulars of areas were furnished worked out at 34.54 bushels for wheat and 39.75 bushels for oats. The bulk of the threshings was in Canterbury.



The New Zealand Journal of Agriculture.

VOL. XX.—No. 5.

WELLINGTON, 20TH MAY, 1920.

SOILS OF THE MANAWATU DISTRICT.

PART I. THE SAND-DUNES: A POTENTIAL ASSET.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

THE chemical composition of sand-dunes is too often considered to be unworthy of investigation, and dismissed on the assumption that the sand-grains are all quartz (silica), and that, therefore, as soils, dune-sands are permanently poverty-stricken. While this may be so in the majority of countries, it should be borne in mind that there is hardly any limit to the hardness and chemical composition of material which may form sand-dunes or sand-deposits. In the Tularosa Desert, northern Mexico, the moving sand is composed not of silica but gypsum (hydrated calcium sulphate), with a hardness of only 1.5 to 2,* enabling it to be scratched with the finger-nail. At Enderby Island (Auckland Islands) the sand-dunes are composed (as the writer has shown elsewhere) of the remains of sea-animals, the sand being almost pure carbonate of lime, with a probable hardness of 3.5 to 4. Mica, with a hardness of 2 to 3, is a large constituent of Otago sand-dunes. Quartz has a hardness of 7, while garnet, which forms certain sands in Otago, may be even harder than

*The maximum figure in the scale of hardness—i.e., 10—is assigned to diamond.

quartz, and zircon sands are not unknown with a hardness of 7.5. Other siliceous minerals which occur in sands are the feldspars and hornblende. In Carolina occurs monazite sand, largely a phosphatic compound of the rare elements. In the North Island of New Zealand volcanic ejectamenta frequently take the form of sands and form fertile soils. There is therefore no adequate reason for regarding sandy soils as inherently poor in mineral plant-food.

So far from being deficient in mineral plant-food the dune-sands of the Manawatu must be accounted not only rich but very rich in available plant-food. Where the total phosphates are low there is some evidence that this is due to the solvent action of the sea water or spray, and that the high amount of available (or soluble) phosphate is one of the causes of the low amount of insoluble phosphate present. Some surprise has been expressed by certain authors that littoral sand-dunes growing what is considered a halophyllous (salt-loving) vegetation contain so little salt, an attitude of mind difficult to reconcile with the fact that salt is soluble in water and the rainfall in most coastal climates of the Temperate Zones would be ample to wash most of the salt from the porous soil and subsoil after deposition. The soil found above the high-tide level on the Waikanae beach has only 0.014 per cent. of salt, while the subsoil (the second 9 in.) contained more than double this—namely, 0.03 per cent. As most farm-crops are able to endure 0.25 per cent. of salt in the soil, and grasses grow well where there is as much as 1 per cent. present (Hall), one would not expect to find any sterility on sandhills caused by salt. It would be in the flat estuarial lands subject to periodical submergence by sea-water that damage would result.

There is considerable evidence to show that the sandhills of the North Island littoral—at least, on the western coast—are richer in mineral plant-food than similar soils of other countries. The statement of the chemical analyses which follows later bears this out with regard to the dune-sands of the Wellington Province, which are estimated to cover an area of not less than 90,000 acres. A belt of dunes extends from Pakakariiki to Patea—a distance of 170 miles. From the mouth of the Manawatu River to that of Wangachu there is an average width of two miles and a half of sand-dune country which is sometimes as much as six miles wide. In the far north of New Zealand there are extensive areas of sand country which in all probability had its origin from land very much to the south, having been transported by the tides and currents. These in New Zealand have a persistent northerly trend, and therefore the northern sand areas may be expected to have a similar composition to similar lands in the south. There is some experimental evidence supporting this, as in 1915 some samples were analysed for the Forestry Branch of the Lands Department (collected by Mr. E. Phillips Turner) which showed a similar composition to those from the Wellington dunes, being well supplied with available phosphoric acid and other mineral plant-food, especially lime (see analysis E 1027).

The necessity of adopting an energetic sand-dune policy at present may be urged under the following heads:—

1. The neglect of wandering dunes or sand in an unstable state is a serious menace to good land already existing on fixed dunes, or even to land which is not dune country but which adjoins it. There

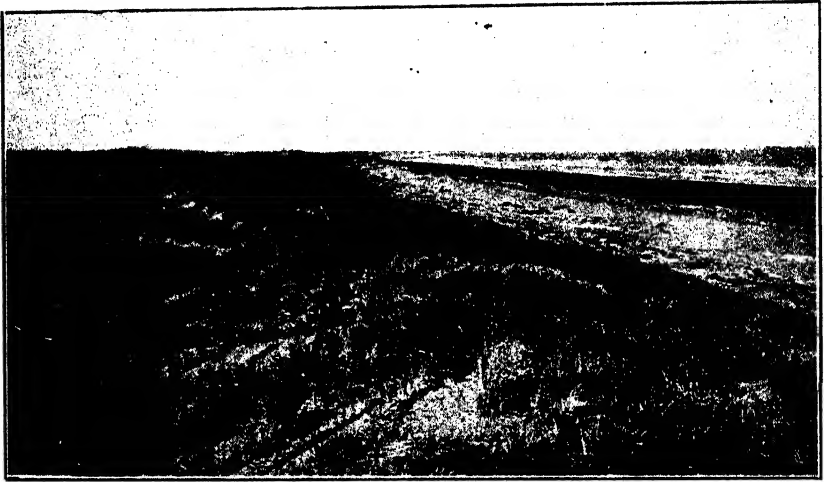


FIG. 1. WAIKANAE BEACH (LOOKING SOUTH).

Barren sand at high tide, and outer foredune with pure association of *Spinifex hirsutus*. Characteristic of soil-samples H 380, H 357, &c.



FIG 2. SAME SPOT AS FIGURE 1, BUT LOOKING NORTH.

Outer foredune and inner foredune, showing the long above-ground stems of *Spinifex* and the sharp distinction in vegetation of outer and inner foredune. Typical of samples H 357 to K 285.

[Photos, B. C. Aston.]

are numerous instances recorded in geological works of the destructive effect of wandering sand in New Zealand.

2. The "bringing in" of fresh country at the present time is a distinct need when readily accessible land is at such a premium.

3. The inauguration of a Forestry Department at the present time would indicate that the best advice will be available in applying the latest methods of dealing with shifting sands.

4. Large quantities of two classes of soil (humus and sandy) exist side by side, each suffering from exactly that deficiency which the other would supply in order to make a highly fertile soil. The problem of mixing the two is an engineering one, and one which might be expected to receive sympathetic consideration from the Public Works Department.

5. The proximity of much of the dune country to the main arterial roads and railways, the bountiful rainfall, good climate, and long growing season of the North Island coastal districts, and the richness in mineral food of the sand, all conspire to make the reclamation of the dune country not only a fascinating problem, but one which has great possibilities economically.

NOTES ON THE SOILS ANALYSED.

The samples of sand-dune soils analysed and here recorded were all collected by the writer, or under his personal supervision, to a uniform depth of 9 in., with a soil-sampler similar to that recommended by A. D. Hall ("The Soil"), each sample being made up of a number of similar subsamples. The subsoils were taken in a similar way to the depth of a further 9 in. below the soils.

BARREN SANDS.

The samples recorded as H 380-81 in the accompanying tables were collected (12/11/16) on the Waikanae beach (Sec. 36, Blk. V, Kaitawa S.D.) just above spring high-tide level, about 60 ft. on the seaward side from the *Spinifex* outer foredune.* This is barren of plant-growth, chiefly on account of its mobile character, but also, no doubt, partly on account of the occasional submergence with salt water. The analyses of the soil and subsoil taken in this station are interesting as showing the first stages in the evolution of a fertile soil from recently deposited

* The author recognizes two distinct portions of the foredune—the outer foredune, originally a pure association (silver-grey in colour) of *Spinifex hirsutus*, but now frequently invaded by the naturalized marram-grass (*Ammophila arundinacea*), and with occasional bright-yellow patches of *Scirpus frondosus*; and the inner foredune, which runs parallel with the outer foredune on the landward side of it, and grows a vegetation consisting of *Scirpus frondosus*, *Coprosma acerosa*, *Cassinia leptophylla*, *Scirpus nodosus*, and *Pimelea arenaria*, *Deyeuxia Billardieri*, *Spinifex*, *Arundo conspicua*, *Sonchus asper*, *Carex Buchanani*, *Calyptegia Soldanella*, *Cyathodes acerosa*, *Leptospermum ericoides*, and the naturalized *Lupinus* sp., *Festuca myurus*, *Aira caryophyllea*, *Erigeron canadensis*, *Trifolium arvense*, *Hypochaeris radicata*, *Rumex Acetosella*, and *Silene gallica*. The significance of this note is that it illustrates an example of a well-defined and characterized change of vegetation not connoting any noticeable change in the quality of the soil. The change is probably due to climatic causes—i.e., the inner foredune is protected by the outer foredune from the wind, and is therefore warmer and the soil more stable.

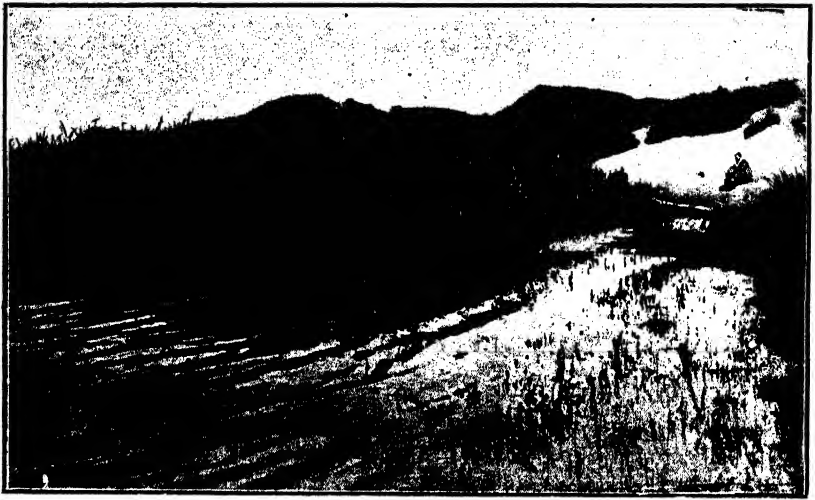


FIG. 3. HUMUS-MAKING RAUPO (*TYPHA ANGUSTIFOLIA*) SWAMP, WAIKANAE.

Showing the semi-stabilized dunes being converted into good land by swamp-plants.



FIG. 4. SEMI-STABILIZED DUNE, WAIKANAE, BEING FIXED BY LUPINS AND WILD CONVULVULUS (*CALYSTEGIA SOLDANELLA*). [Photos, B. C. Aston.

mineral matter. A noteworthy fact is the comparatively high amount of mineral plant-food present in an available (citric-acid soluble) condition. The total amount of plant-food extracted by hydrochloric acid is also high. The presence of carbonate of lime, which this and the foredune soils contain, marks these two soils off sharply from the more stable dune-soils lying to the landward. The loss of weight on ignition to redness representing organic matter and combined water is, of course, small, showing, as one would expect, a great deficiency in exactly that constituent necessary to convert the sand into a fertile soil. The improvement of the moving sand into a fertile soil as the sea recedes* therefore depends, after its fixation into a stabilized dune, largely on the amount of organic matter which can be introduced into it by the action of successive forms of plant-life.

FOREDUNES.

The sample H 357 was taken (12/11/16) on a 300-yards frontage in a pure association of *Spinifex* on the outer foredune at Waikanae beach—a natural rampart of sand which stretches for many miles north and south from the spot where the samples and photographs were taken. The photos show very well the pure association of *Spinifex* on the outer foredune (Sec. 36, Blk. V, Kaitawa S.D.). H 382 was taken (12/11/16) in the inner part of the foredune in a mixed association of *Coprosma acerosa* and many other plants (see footnote on page 276), immediately adjacent on the landward side to the area sampled in H 357 (Sec. 36, Blk. V, Kaitawa S.D.). H 625 was taken (3/3/17) at Levin beach over half a mile of frontage amongst a pure *Spinifex* association on the foredune comparable with H 357 (Sec. B42, Blk. IV, Moutere S.D.). J 104 was taken (28/4/17) from coastal dunes on the Foxton beach within half a mile of the sea on a wandering dune, the only vegetation (discontinuous) being *Scirpus frondosus*, marram-grass, and *Spinifex* (Blk. IV, Sandy S.D.). K 283, taken (25/8/18) from Levin outer foredune, about 20 ft. above high water, in a pure association of *Spinifex*, with occasional clumps of marram. This foredune is similar to that at Waikanae beach, but much higher, and extending north and south in an unbroken line as far as the eye can reach. A difference between this and the Waikanae is that there is no well-defined inner foredune as at Waikanae (Sec. 1, Blk. III, Moutere S.D.). K 285 was taken (25/8/18) on inner wandering dunes near Levin, 40 ft. above sea; vegetation, *Scirpus frondosus*, *Cassinia leptophylla*, *Pimelea arenaria*, *Leptospermum scoparium*, *Leptocarpus simplex*, *Deyeuxia Billardieri*, *Spinifex hirsutus*, *Arundo conspicua* (Sec. 1, Blk. III, Moutere S.D.). K 366 was taken (21/9/18) from an outer foredune at Paraparaumu, growing vegetation consisting chiefly of marram-grass, but also mixed with *Spinifex* and *Scirpus frondosus* (Blk. III, Kapiti S.D.). K 368 was taken (21/9/18) from an inner foredune at Paraparaumu, growing *Spinifex*, *Scirpus nodosus*, *Coprosma acerosa*, *Cassinia leptophylla*, *Pteris esculenta*, *Pimelea arenaria*, *Deyeuxia Billardieri*, *Hypochaeris radicata*, *Carex comans* or *Buchanani* (Blk. III, Kapiti).

* The sea is receding all along the coast. The encroachment of land into the sea roughly measured by the present owner (a surveyor) of some miles of sea frontage, as the result of some thirty years' experience, is estimated by him as being one chain in ten years.

As one would expect, there is little difference between the composition of barren sand and that of the foredune. It is only plants which are specially adapted to survive on a moving sand by the quick production of underground and above-ground stems of enormous length that can hope to survive on a moving soil, the direction of the motion of which may vary with the direction of wind, resulting possibly in the uncovering of entire plants. Such a vegetation is not calculated to increase the organic matter in the soil, the portion decaying above ground being more easily blown away than buried, while the portion below ground stretches through such a depth of soil that it would not appreciably affect the composition of the top 9 in. from which the samples are collected. Hence the amount of the organic matter of the foredune is not appreciably greater than that of the barren sand

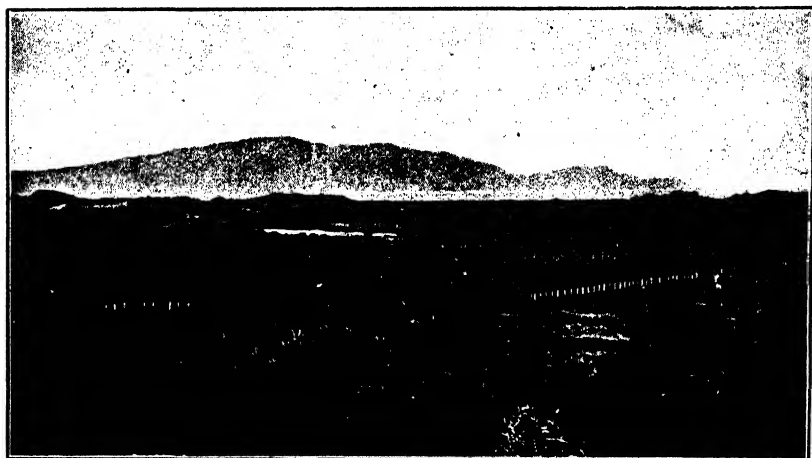


FIG. 5. SEMI-STABILIZED AND STABILIZED DUNES—THE LATTER EITHER PASTURE OR DUNE HEATH

Kapiti Island in the distance.

alongside, and the same is true of the nitrogen-content. The comparatively large amount of salt (soluble chlorides) in the sand nearest the sea should be noted. Regarding the phosphoric-acid content of this series of sands, it will be seen that the coarser the soil the higher the percentage of available phosphate. Generally speaking, where the sand has been mixed with finer material—silt or clay—derived probably from a different source from that from which the sand originated (the sand probably progressing inland by the aid of the sea and the sea-winds, while the silt and clay are progressing seaward by the aid mainly of rivers and floods),* the percentage of available phosphate is at once lowered. Usually, the nearer the sea the more available phosphate there is in the sand. This may be due to the action of the salts

* An alternative theory is that the finer particles are blown farther from the sea, and hence the sand farthest from the sea should contain the finest particles.

of the sea-water acting on the insoluble phosphate and making it available or soluble. The high amount of available phosphate compared with the total quantity present in areas near the sea has been noticed by the writer before (see articles in this *Journal*, "The Hauraki Plains," June, 1914, and "Some Typical Nelson Soils," August, 1919). It is a fact particularly conspicuous in these littoral sandy soils, and suggests that the high availability may be only a stage in the attack—the solution and the subsequent removal of the phosphate by a leaching action by salt water. The latter contains sodium and magnesium chlorides, and these salts by reacting with the silicates, phosphates, and carbonates of the soil may render possible the removal of phosphates from the top soil by leaching, which rarely occurs in nature. In connection with the interaction of phosphates with chlorides it is significant to note the occurrence* at Cape Cross, South-west Africa, of a mixture of phosphates and chlorides of sodium and magnesium recently recorded, in which mixture two-thirds of the phosphate was present as soluble in weak citric acid or "available." The reaction may be a slow one, but it is certainly worth experimenting with from a commercial point of view to ascertain whether any improvement in availability of insoluble phosphates can be effected by mixing with cheap chlorides or sea-salts.

STABILIZED DUNES.

Sample H 359 was taken (4/11/16) in a dune heath near the Waikanae beach (Sec. 36, Blk. V, Kaitawa S.D.). H 374 was taken (12/11/16) on a grassed dune on the highest sandhill near Waikanae, on land never ploughed, but covered with a vegetation of sweet vernal, rye-grass, *Microlaena*, &c. (Sec. 38, Blk. V, Kaitawa S.D.). H 377 was taken (12/11/16) in a grass-dune paddock at Waikanae, which has been ploughed, the pasture consisting of *Festuca myurus* and other poor grasses (Sec. 37, Blk. V, Kaitawa S.D.). H 627 was taken (3/3/17) half a mile from the sea, at Levin beach, in a dune heath of *Leptospermum ericoides* (tall manuka), *Pteris esculenta* (bracken-fern), *Arundo* (toetoe), *Cassinia leptophylla* (tauhinu), *Leucopogon Fraseri*, and *Microlaena* (B42, Blk. IV, Moutere S.D.). J 114 was taken (29/4/17) from a grassed dune near Paekakariki Railway-station, above the golf-links, the pasture being chiefly *Sporobolus indicus* (ratstail), *Microlaena*, and English pasture grasses (Sec. 52, Blk. III, Paekakariki S.D.). J 164 was taken (12/5/17) in flat sandy land (dune plain) inside the dunes at Otaki beach, near the sea; vegetation, *Mariscus*, *Juncus*, *Carex*, mixed with tall fescue and English pasture grasses (Blk. VI, Waitohu S.D.). K 287 was taken (25/8/18) in the first dune plain inside the broken dunes at Levin beach; vegetation, closed sward of *Danthonia pilosa*, with *Poa pratensis*, containing also *Arundo*, *Juncus effusus*, *Mariscus*, *Festuca bromoides*, and *Acaena*, sorrel, Yorkshire fog, and *Geranium molle* (Sec. 1, Blk. III, Moutere S.D.). K 289, Levin-Foxton Road dunes, was taken (25/8/18) from the second row of semi-stabilized dunes, containing very little *Danthonia*, the grass covering being not at all good; vegetation chiefly *Scirpus frondosus*, *Coprosma acerosa*, *Arundo*, *Cassinia leptophylla* Yorkshire fog, *Carex Buchanani*, *Pimelea arenaria*, *Leucopogon Fraseri*, *Lupinus arboreus*, *Carmichaelia*, *Discaria*,

* Report of Agricultural Research Chemist, Union of South Africa: Appendix XI, c. 19, 1918, page 5.

marram-grass, bracken, *Muehlenbeckia complexa*, *Trifolium arvense*, and *Trifolium glomeratum*. This series of inner dunes is badly affected by the wind, and is at an elevation of about 90 ft. above sea (Sec. I, Blk. III, Moutere S.D.). K 383 was taken (25/8/18) from a grassed dune near Te Horo, adjacent to white-pine forest; vegetation, *Microlaena* and English pasture grasses (Blk. II, Kaitawa S.D.).

The most striking difference in the composition of the stabilized dunes compared with the foredunes is the increase in the amount of matter lost on ignition (organic matter) and in the total nitrogen. It will be noticed that the samples grouped under the term "stabilized dunes" are themselves divisible into two other divisions—the dune heaths and the dune pastures. The former, coming immediately after the foredunes, are usually nearer the sea than the pastures. The dune heath has usually less organic matter and nitrogen than the dune pasture. The amount of available phosphoric acid in these samples is still very high. The carbonate of lime—as one would expect from the rapid leaching to which these dunes are subject—has disappeared. The total calcium has also accordingly diminished, and coincident with this decrease is an increase in the figure for "lime-requirement," which now becomes a positive quantity, though a small one. The high availability in phosphates of some of these soils is quite striking compared with the total amount of phosphate.

STABILIZED SILTY SAND-DUNES.

Sample H 386 was taken (12/11/16) in dune pasture near swampy forest far from sea, Waikanae, in good English grasses (Sec. 45, Blk. V, Kaitawa S.D.). H 407 was taken (23/11/16) in dune pasture, far from sea ("Telegraph Paddock"), Waikanae, in poor English grasses, *Festuca myurus*, mixed with *Danthonia semiannularis* and *Microlaena stipoides* (Sec. 37, Blk. IV, Kaitawa S.D.). J 102 was taken (8/4/17) from dune pasture on the Longburn-Foxton Road, ten miles and a half from Longburn; a reddish sandy soil with some humus on top. J 106 was taken (29/4/17) in dune pasture near the Manawatu Bridge, Foxton, the vegetation consisting of English pasture grasses, *Microlaena*, and *Scirpus nodosus*; soil black to brown in colour (Blk. IX, Moutere S.D.). J 108 was taken (29/4/17) on dune pasture at Big Trig. Hill (180 ft.), Levin, immediately west of Horowhenua Lake; vegetation, English pasture grasses and *Microlaena* (Blk. IV, Moutere S.D.). J 110 was taken (28/4/17) in pasture dunes near Big Trig. Hill, Moutere, Levin. This area gives evidence in the mechanical analysis of considerable mixture of silt with the sand, and therefore the dune sands have probably been mixed with detritus brought down by floods (Blk. IV, Moutere S.D.). J 169 was taken (12/5/17) in bracken association in the Telegraph Paddock, near where H 407 was taken. K 251 was taken (19/8/18) in pasture sand-valley; vegetation, *Danthonia pilosa* sward, with little *Microlaena* and *Trifolium arvense* in good close sward; soil black to depth of 9 in.; situated about a mile from Levin beach. K 253 was taken (19/8/18) near MacDonald's woolshed, on parallel dune on Levin-Foxton Road (Sec. 4, Blk. XIII, Mt. Robinson S.D.); vegetation, sward of *Danthonia pilosa*. K 291 was taken (28/8/18) in the third line of sand-dunes running at right angles to the coast. This is the first really stable sandy land met with in proceeding inland from the

coast in the area south of the Marawatu River mouth. The sample was collected on one of the remarkable long parallel dunes so characteristic of this area. Vegetation consists of a close sward of *Poa pratensis*, *Microlaena stipoides*, *Danthonia pilosa*, and *Trifolium minor*, and a conspicuous native plant dotted about is *Scirpus nodosus*. A black sandy soil; 95 ft. above sea-level (Sec. 1, Blk. III, Moutere S.D.). K 370 was taken (21/9/18) from dune pasture, a black sandy soil, about half a mile from the beach at Paraparaumu; vegetation, pasture grasses and *Mariscus* (Blk. III, Kapiti S.D.). L 139 was taken (15/6/19) in pasture dune on Laurie's farm, at Te Horo; vegetation, *Danthonia* and English pasture grasses in close sward (Blk. II, Kaitawa S.D.). L 429 was taken (20/9/19) in pasture dune near Phillips's farm, Paekakariki; vegetation, close sward of *Danthonia* and English pasture grasses (Blk. II, Kapiti S.D.).

The remarkable point about these dunes is the admixture of silt, fine silt, and in some cases a trace of clay. All the previous samples noticed contained from 80 to 98 per cent. of coarse and fine sand mixed with varying amounts of organic matter, and only traces of silts. Now, as one progresses away from the sea the dunes commence to show traces of the finer-sized fractions of mineral matter, which, by improving the mechanical state of the soil and by decreasing the excessive porosity and instability when dry, tends to remove those disabilities from which all sandy soils suffer. It will be noted that the average nitrogen is slightly higher, but the most marked chemical difference is the fall in the amount of available phosphoric acid compared with that in the sand-dunes. The average in the sand-dunes is 0.031 per cent., but in the silty sands only 0.0125 per cent. There is not much difference in the amounts of the other constituents, but the lime-requirement figure shows a decided average increase in the silty sands.

FOREST DUNES.

H 355 was taken (4/11/16) on a forest dune, Waikanae, near the railway-station (Blk. VI, Kaitawa S.D.). K 249 was taken (20/8/18) in a forest dune, Waikanae, nearer the sea than H 355. Vegetation: Forest—*Dysoxylum spectabile*, *Beilschmiedia Tawa*, *Knightia excelsa*, *Myrsine Urvillei*, *Melicytus ramiflorus*, *Alectryon excelsum*, *Corynocarpus laevigata*. Underscrub—*Melicope ternata*, *Cyathea dealbata*, *C. medullaris*, *Dicksonia squarrosa*, *Pteris tremulentum*, *P. incisa*, *Pittosporum tenuifolium*. Epiphytes—*Freycinetha*, *Griselinia lucida*, *Astelia Solandri*, *Pittosporum cornifolium*, and *Metrosideros scandens*.

The dune forest marks the highest point in the evolution of the sand-dunes natural covering. The soils are only slightly mixed with silt, but, as one would expect, the loss on ignition is high, due to the larger amount of organic matter of humus which is present, owing to the permanent covering of vegetation and the continuous dropping of dead leaves and vegetable remains.

OTHER SANDS.

E 976-1-2 and E 1027 were samples collected by the Forestry Officer, received from the Lands Department in August, 1914, with a request to ascertain the capacity of the land for carrying plant-growth. E 976-1-2 were collected from Rangitikei dunes, and E 1027 from the dunes at the mouth of the Waikato River.

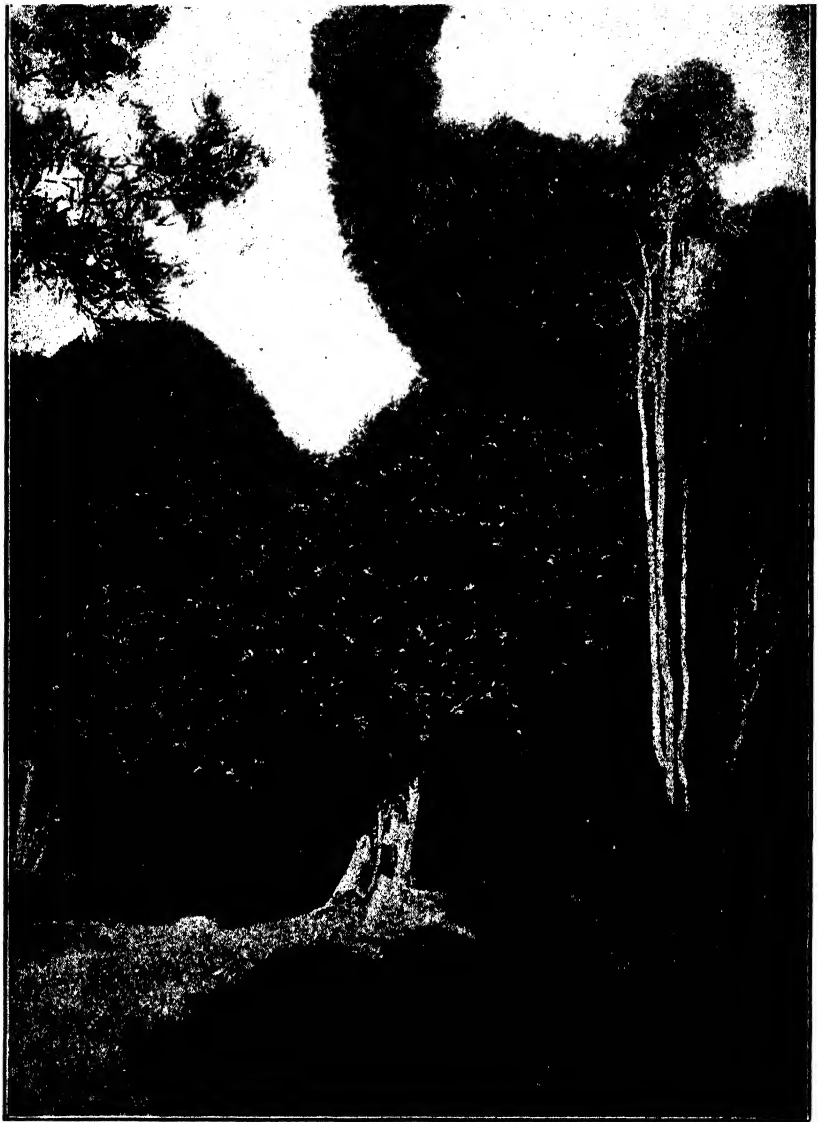


FIG. 6. DUNE FOREST, WAIKANAE.

New Zealand mahogany (*Dysoxylum spectabile*), which is sometimes 11 ft. in circumference, is the chief component of this forest. Also are present *Knightia* and *Pseudopanax*. The camera-case against mahogany-tree in centre shows the scale. Characteristic of samples H 355 and K 249.

[Photo, B. C. Aston.]

MANAWATU DISTRICT SAND-DUNE SOILS.—CHEMICAL ANALYSES.
Results except * are percentages on soil dried at 100° C.

Laboratory No.	Locality.	Volatile Matter.			Total Nitrogen.	1-per-Cent. Citric-acid Extract, Dyer's Method; Hall's Modification ("Available" Plant-food).				Hydrochloric-acid Extract ("Total" Plant-food).				Lime-requirement (Percentage CaCO ₃).		Chlorine = Sodium Chloride (Salt) NaCl.	Carbon Dioxide = Calcium Carbonate CaCO ₃ .	
		* On Air-drying.	* At 100° C.	On Ignition.		Lime, CaO.	Magnesia, MgO.	Potash, K ₂ O.	Phosphoric Acid, P ₂ O ₅ .	Lime, CaO.	Magnesia, MgO.	Potash, K ₂ O.	Phosphoric Acid, P ₂ O ₅ .	On Air-dried Soil.	On Soil dried at 100° C.			
H 380	<i>Sterile Sands.</i> Waikanae beach ..	6.0	Trace	0.54	0.040	..	..	0.037	0.027	1.25	0.66	0.19	0.23	0.03	0.03	0.014	0.18
H 381		7.0		0.87	0.028	..	..	0.023	0.027	1.04	0.72	0.08	0.16	0.03	0.03	0.033	0.10
H 357	<i>Foredunes.</i> Outer foredune, Waikanae .. Inner foredune, Waikanae .. Outer dune, Levin .. Shifting dune, Foxton .. Outer foredune, Levin .. Inner foredune, Levin .. Outer foredune, Paraparaumu .. Inner foredune, Paraparaumu ..	5.0	0.270	0.81	0.042	..	..	0.027	0.031	1.16	0.66	0.07	0.09	0.01	0.01	0.004	0.16
H 382		4.0	0.268	0.36	0.051	..	..	0.011	0.024	1.07	0.66	0.08	0.07	Nil	Nil	0.002	..
H 625		..	0.266	0.44	0.028	0.028	0.010	0.018	1.26	0.46	0.07	0.09	0.02	0.02	..	0.48
J 104		17.0	0.310	0.84	0.008	0.036	0.175	0.050	0.024	0.036	1.59	0.36	0.14	0.10	0.02	0.02	..	0.34
K 283		2.9	0.28	0.66	0.036	0.014	0.108	0.032	0.024	0.037	1.74	0.67	0.24	0.05	0.03	0.03
K 366		1.3	0.24	0.62	0.014	0.023	0.288	0.047	0.023	0.021	1.53	0.43	0.26	0.06	0.02	0.02
K 368		5.9	0.36	0.94	0.023	0.031	0.125	0.033	0.024	0.029	1.33	0.43	0.26	0.07	0.02	0.02
H 358	<i>Subsoils of Foredunes.</i> Subsoil of H 357 .. Subsoil of H 382 .. Subsoil of H 625 .. Subsoil of J 104 ..	4.0	0.300	0.92	0.056	..	..	0.026	0.032	1.22	0.68	0.06	0.09	0.03	0.03	0.002	0.07
H 383		5.0	Trace	0.62	0.056	..	..	0.011	0.035	0.98	0.67	0.10	0.06	Nil	Nil	0.002	..
H 626		..	0.34	0.54	0.028	0.028	0.006	0.013	1.11	0.57	0.04	0.08	0.02	0.02	..	0.40
J 105		21.0	0.33	0.71	0.048	0.048	0.007	0.018	0.86	0.44	0.11	0.11	0.02	0.02	..	0.34
H 359	<i>Stabilized Dunes.</i> Near sea, in dune heath, Waikanae .. About one mile from sea, in dune pasture, Waikanae .. About one mile from sea, in dune pasture, Waikanae .. Manuka dune heath, half-mile from sea, Levin ..	10.0	0.69	1.62	0.084	..	..	0.005	0.035	1.31	0.58	0.03	0.14	0.02	0.02	0.001	..
H 374		5.0	1.66	5.10	0.149	..	..	0.010	0.036	0.91	0.64	0.07	0.10	0.07	0.07	0.004	..
H 377		8.0	1.56	2.19	0.160	..	..	0.010	0.032	0.82	0.55	0.11	0.19	0.11	0.11	0.005	..
H 627		..	3.26	2.89	0.080	..	..	0.009	0.032	0.95	0.46	0.07	0.11	0.06	0.06	..	..
J 114	Dune pasture, Paekakariki .. Wet sand plain, inside dunes, Otaki ..	7.0	4.76	6.75	0.209	..	..	0.012	0.018	0.94	0.21	0.14	0.10	0.14	0.15	..	..
J 164		14.0	2.56	6.87	0.211	..	..	0.031	0.018	0.74	0.45	0.12	0.07	0.12	0.12	..	..
J 353	Dune, Foxton .. Dune heath pasture, Levin .. Dune heath pasture, Levin .. Dune pasture, Te Horo ..	..	Nil	1.79	0.050	..	..	0.008	0.041	0.97	0.21	0.08	0.07	..	..	..	..
K 287		5.2	1.10	6.89	0.105	0.157	0.041	0.025	0.039	1.73	0.67	0.26	0.08	0.01	0.01	..	..
K 289		18.5	0.64	6.80	0.079	0.023	0.011	0.023	0.011	1.70	0.66	0.25	0.08	0.02	0.02	..	..
K 383		15.4	3.38	5.81	0.205	0.098	0.020	0.027	0.011	1.21	0.41	0.24	0.07	0.12	0.12	..	..

Subsoils of Stabilized Dunes.															
H 360	5.0	0.30	1.11	0.034	..	..	0.006	0.032	1.34	0.65	0.06	0.09	0.01	0.09	0.001
Subsoil of H 359	..	..	1.95	0.109	..	..	0.008	0.042	0.99	0.63	0.12	0.09	0.09	0.09	0.002
H 373	6.0	0.39	2.19	0.070	..	..	0.012	0.018	1.13	0.62	0.21	0.12	0.02	0.02	0.003
Subsoil of H 374	..	0.86	1.83	0.053	..	..	0.013	0.029	0.90	0.60	0.07	0.11	0.02	0.02	..
H 378	..	..	..	..	..	..	0.006	0.018	0.96	0.23	0.14	0.09	0.08	0.08	..
Subsoil of J 114	11.0	2.83	3.32	0.114	..	..	0.015	0.024	0.78	0.58	0.14	0.08	0.05	0.05	..
Subsoil of J 164	4.0	1.51	3.80	0.087	..	..	0.009	0.041	0.78	0.24	0.12	0.06	..	..	..
Subsoil of J 353	..	0.49	0.73	0.020	..	..	..	..	..	..	..	..	..	..	..
Stabilized Silty Sand-dunes.															
H 386	15.0	4.90	4.33	0.118	..	..	0.013	0.016	0.91	0.58	0.18	0.11	0.15	0.16	0.007
Dune pasture, Waikanae	..	0.73	4.51	0.142	..	..	0.026	0.023	1.30	0.50	0.26	0.14	0.14	0.14	..
H 407	14.0	5.16	5.47	0.219	..	..	0.017	0.016	1.01	0.26	0.14	0.13	0.13	0.13	..
Dune pasture, Longburn-Foxton Road	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
J 106	9.0	5.90	6.01	0.211	..	..	0.017	0.009	1.14	0.46	0.15	0.08	0.10	0.11	..
Dune pasture, Foxton Road	10.0	4.89	6.11	0.218	..	..	0.027	0.009	1.12	0.28	0.09	0.07	0.13	0.14	..
J 110	10.0	4.91	5.37	0.180	..	..	0.017	0.005	0.97	0.80	0.13	0.07	0.15	0.16	..
Dune pasture, near Trig. Hill, Levin	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
J 169	9.0	2.34	6.31	0.210	..	..	0.022	0.013	0.79	0.46	0.14	0.08	0.18	0.18	..
Dune pasture, Waikanae	..	2.62	5.22	0.242	..	..	0.035	0.031	1.22	0.61	0.31	0.04	0.11	0.11	..
K 251	..	3.80	6.20	0.233	..	..	0.031	0.019	1.33	0.50	0.26	0.28	0.10	0.10	..
K 453	16.0	3.02	6.33	0.225	..	..	0.046	0.022	1.56	0.57	0.28	0.07	0.09	0.09	..
Dune pasture, Foxton Road	22.6	2.92	8.77	0.317	..	..	0.037	0.009	1.30	0.33	0.24	0.04	0.20	0.20	..
Dune pasture, Paraparaumu	8.0	2.42	6.10	0.205	..	..	0.028	0.012	..	..	..	..	0.18	0.18	..
Dune pasture, Te Horo	24.6	3.58	8.84	0.276	..	..	0.021	0.011	1.15	0.39	0.20	0.07	0.19	0.20	..
Dune pasture, Pakakahi	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Subsoils of Stabilized Silty Sand-dunes.															
H 387	10.0	2.26	3.67	0.068	..	..	0.009	0.015	0.91	0.52	0.15	0.08	0.06	0.06	0.004
Subsoil of H 386	..	1.82	1.57	0.066	..	..	0.021	0.028	0.91	0.34	0.21	0.06	0.06	0.06	..
Subsoil of H 407	12.0	1.48	1.37	0.063	..	..	0.011	0.028	0.90	0.25	0.10	0.11	0.01	0.01	..
J 103	7.0	1.08	3.54	0.069	..	..	0.013	0.008	1.06	0.45	0.08	0.10	0.04	0.04	..
Subsoil of J 102	10.0	3.08	3.54	0.068	..	..	0.024	0.008	1.00	0.30	0.12	0.05	0.05	0.05	..
J 109	..	..	..	..	..	..	0.014	0.006	1.06	0.35	0.09	0.07	0.05	0.05	..
Subsoil of J 108	7.0	2.43	3.70	0.068	..	..	0.008	0.014	1.00	0.33	0.14	0.08	0.08	0.08	..
Subsoil of J 110	7.0	1.73	2.39	0.080	..	..	..	..	1.02	0.33	0.14	0.08	0.08	0.08	..
Subsoil of J 169	4.0	1.69	3.77	0.081	..	..	..	..	..	..	..	..	..	..	..
Dune Forest.															
H 355	10.87	5.49	5.47	0.100	..	..	0.009	0.009	1.19	0.38	0.21	0.09	0.07	0.07	0.010
Dune forest, Waikanae	..	2.72	8.45	..	..	0.238	0.004	0.010	1.48	0.60	0.33	0.16	..	..	..
Dune forest, Waikanae	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
H 356	9.0	1.87	3.15	0.115	..	..	0.004	0.012	1.32	0.499	0.04	0.07	0.08	0.08	0.008
Subsoil of H 355	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Other Sands.															
E 976-1	..	0.08	0.35	..	..	..	0.014	0.031	1.58	0.54	0.15	0.06	..	..	..
Sand from Rangitikei dunes	..	0.14	0.44	..	..	..	0.012	0.031	1.52	0.49	0.19	0.06	..	..	..
E 976-2	..	0.20	0.33	..	..	..	0.013	0.012	1.99	0.74	0.09	0.05	..	..	..
Sand from Rangitikei dunes	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
E 1027	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sand from Waikato Heads	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

NOTE.—The minus sign before "lime-requirement" figures indicates that the soil gives up lime, instead of absorbing it, when shaken with a solution of calcium bicarbonate. Hutchinson and MacLennan method used.

MANAWATU DISTRICT SAND-DUNE SOILS.—MECHANICAL ANALYSES.

Results are percentages on air-dried soil.

Lab. No.	Description of Soil. (Classification of U.S. Department of Agriculture, modified.)	Analysis of "Fine Earth" passing 2 mm. Sieve.						Stones and Gravel.
		Fine Gravel.	Coarse and Fine Sand.	Silt.	Fine Silt.	Clay.	Moisture and Loss on Ignition.	
H 380	Sterile sand	Nil	97.7	0.1	Nil	Nil	0.6	..
H 381	"	"	97.7	0.1	"	"	0.9	..
H 357	Foredune	"	98.4	0.1	0.1	"	1.1	..
H 382	"	"	97.9	0.6	Nil	"	0.8	..
H 625	"	"	97.7	0.1	Trace	"	0.7	..
J 104	"	"	98.1	"	"	"	1.2	..
K 283	"	"	98.7	Nil	Nil	Nil	0.9	..
K 285	"	"	98.3	"	"	"	0.9	..
K 366	"	"	97.3	"	"	"	0.5	..
K 368	"	"	97.4	"	"	"	1.7	..
H 358	Subsoils of foredunes ..	"	98.5	0.2	Trace	"	0.7	..
H 383	"	"	97.6	0.1	Nil	"	0.9	..
H 626	"	"	97.1	0.1	"	"	0.9	..
J 105	"	"	97.4	Nil	"	"	1.1	..
H 359	Stabilized dunes	"	96.5	0.5	0.1	"	2.3	..
H 374	"	"	90.3	1.4	0.2	"	6.8	..
H 377	"	"	92.2	2.4	0.2	"	3.7	..
H 627	"	"	93.8	1.9	0.2	"	3.3	..
J 114	"	"	85.0	2.2	0.1	"	11.7	..
J 104	"	"	83.6	2.3	0.2	"	9.4	..
J 353	"	"	95.5	0.8	0.3	"	2.1	..
K 287	"	"	91.0	1.3	0.8	"	7.9	..
K 289	"	"	93.0	0.4	Nil	"	7.4	..
K 383	"	"	82.3	4.9	3.1	Trace	9.0	..
H 360	Subsoils of stabilized dunes ..	"	98.8	0.2	Trace	"	1.4	..
H 375	"	"	95.6	0.8	0.1	"	2.1	..
H 378	"	"	95.1	0.8	0.1	"	3.0	..
H 628	"	"	95.6	0.9	0.1	"	1.5	..
J 115	"	"	88.4	2.9	0.1	"	6.2	..
J 165	"	"	83.5	5.7	1.1	"	5.5	..
J 354	"	"	97.0	0.5	0.2	"	0.8	..
H 386	Stabilized silty sand-dunes ..	"	78.9	7.1	1.5	"	9.4	..
H 407	"	"	83.8	5.5	3.0	0.1	5.3	..
J 102	"	"	83.1	3.2	1.1	Nil	10.8	..
J 106	"	"	81.1	4.8	1.2	"	12.1	..
J 108	"	"	77.6	8.0	1.0	0.1	11.1	..
J 110	"	"	75.5	8.0	1.9	0.1	10.6	..
J 169	"	"	84.0	3.1	0.6	"	9.2	4.0
K 251	"	Nil	80.0	5.9	3.3	Nil	9.2	..
K 253	"	"	74.4	6.9	4.5	0.7	..	..
K 291	"	"	80.4	5.4	2.4	0.3	9.3	..
K 370	"	"	74.0	7.5	3.5	2.6	12.1	..
L 139	"	"	85.6	4.8	0.1	Nil	5.9	..
L 429	Subsoils of stabilized silty sand-dunes ..	"	88.1	0.8	0.2	0.1	4.4	..
H 387	Ditto	"	95.1	0.2	0.1	Nil	3.1	..
J 103	"	"	85.6	4.9	1.6	"	0.7	..
J 107	"	"	81.1	8.0	2.2	0.2	5.9	..
J 109	"	"	90.2	2.9	0.5	Nil	4.1	..
J 111	"	"	90.7	2.3	0.1	"	5.5	1.6
J 179	"	1.6	83.2	3.9	Nil	"	11.4	..
H 355	Dune forest	Nil	71.5	7.3	6.6	2.8	11.0	..
K 249	"	"	88.7	3.0	0.3	Nil	5.3	..
H 356	Subsoil of dune forest	"	"	"	"	"	"	"

(To be continued.)

Farrowing of Pigs.—Farmers may be reminded that a fender or rail in the farrowing-pen is often the means of saving the lives of little pigs. A simple method is to place a 2 in. by 4 in. or 2 in. by 6 in. piece of timber about 8 in. above the floor of the pen, nailed firmly to the wall. The sow's body may go up against the side of the pen and strike the rail or fender, and if a little pig is there he has some chance of not being squeezed to death, because the fender keeps the sow's weight off him.—*K. W. Gorringe.*

TAKE-ALL DISEASE IN WHEAT.

ETIOLOGY OF *OPHIOBOLUS GRAMINIS* SACC.

R. WATERS, Biological Laboratory.

SEEING that there is considerable uncertainty in the minds of plant-pathologists as to the cause of the condition known as "take-all" in wheat the following notes upon the pathogenicity of *Ophiobolus graminis* may be of interest:—

In January, 1920, specimens of wheat bearing perithecia of *O. graminis* were collected from various parts of the Canterbury Province. A few of these perithecia were induced to put forth tendrils (see March, 1920, issue of this *Journal*, p. 141), and ascospores therefrom were plated out. The mycelium developing upon beef-peptone-agar is white and shows only slight aerial growth, the hyphae, especially at the edge of the colony, spreading outward through the medium or closely adhering to its surface. When hyphae growing outward at the edge of a colony meet they thereafter frequently continue to develop parallel and adjacent to one another. Thus, under a low power the peripheral hyphae were seen running adjacent to one another, often in bundles of a dozen or more. No fructifications were produced.

On 21st February White Straw Tuscan wheat was sown in a pot, and small pieces of medium containing *Ophiobolus* mycelium were placed upon culms (previously sterilized), which were quickly enclosed in a glass tube plugged each end with cotton-wool. After fifty-four days the plants so treated had not shown signs of disease.

On 15th March, various other unsatisfactory inoculation methods having been tried, six sterilized and aseptically germinated White Straw Tuscan seeds were placed each in a separate tube containing sterile moistened potting-soil. To each of the tubes numbered 1 to 4 a small piece of medium containing mycelium of *Ophiobolus graminis* was added, both seeds and mycelium being placed upon the surface of the sterile soil. To tubes 5 and 6—the controls—no inoculum was added. The plant in tube 1 was dead on 12th April—i.e., twenty-eight days; that in tube 2 was dead on 18th April, thirty-four days; and those in tubes 3 and 4 were dead on 20th April, or thirty-six days. The controls still showed no signs of failing on 12th May—i.e., twenty-two days after the last inoculated plant had died. No fructifications have yet formed upon the plants that have been killed. On 2nd May four pieces of dead wheat rootlet from tube 2 were placed upon a beef-peptone-agar plate. Four days later from all four there had developed an abundant mycelium typical of that originally secured from the plating out of the ascospores of *O. graminis*.

COMMENTS.

1. The failure of the mycelium to produce infection when applied direct to the culms suggests that the fungus causes infection below or at ground-level. If this is so it could certainly spread from plant to plant by means of the roots, and may even be capable of spreading through the soil.

2. The results to date of the experiments in tubes 1 to 6 indicate that *Ophiobolus graminis* is a parasite of wheat, and is at least one of the causes of the "take-all" condition. More extensive experiments are, however, now in hand.

3. An interesting point in regard to these experiments is the rapidity with which death occurred. Delacroix* secured only traces of disease after three or four months. He, however, used ascospores suspended in water, while in the writer's experiments pieces of pure vigorous cultures of mycelium derived from ascospores were placed upon the soil in which the wheat-plants were grown.

4. It may be remarked that in all cases those plants that were nearest to the added inoculum died first:

* Delacroix, 1901, "Sur le piétin des céréales," Bull. Soc. Myc. de France, 17.

Limestones.—Samples of limestone recently analysed by the Chemistry Section gave the following percentages of carbonate of lime: Gladstone, 81 to 92.5; Port Albert, 72 and 80.5; Balfour, 83.; Paparoa, 91; Kaukapakapa, 80; Oamaru, 92.

Ensilage at Weraroa.—Six acres of maize at the Central Development Farm, intended for feeding-out but not required, has been stack-ensilaged, with the addition of threshed pea-straw, the object being to make a better-balanced food ration.

Pasture in the Mackenzie Country.—A pasture and fodder-plant experimental area established by the Department before the war, at Whalesback, in the Mackenzie country, Canterbury, was recently examined, after lying without attention since 1914. Tall oat-grass has done well, and is seeding and spreading over the area. Cocksfoot comes next. Bent-grasses, fescues, red clover, and alsike are also showing up, while white wild clover is covering considerable areas with a strong vigorous mat. Of the deep-rooted plants, sheep's burnet has done well, and yarrow and chicory occupy a prominent place in the several sowings made. A variety test of lucerne was also sown on this area. The Peruvian and Hungarian varieties are the only survivors. This is a case of the survival of the fittest under climatic conditions of great extremes. It has to be remembered that no inoculated soil was applied to the plots seeded to lucerne. The area was securely fenced in, and no stock has been admitted during the period covered.
—A. Macpherson, Fields Supervisor.

CALF-REARING.

FEEDING EXPERIMENTS AT RUAKURA AND WERAROA.

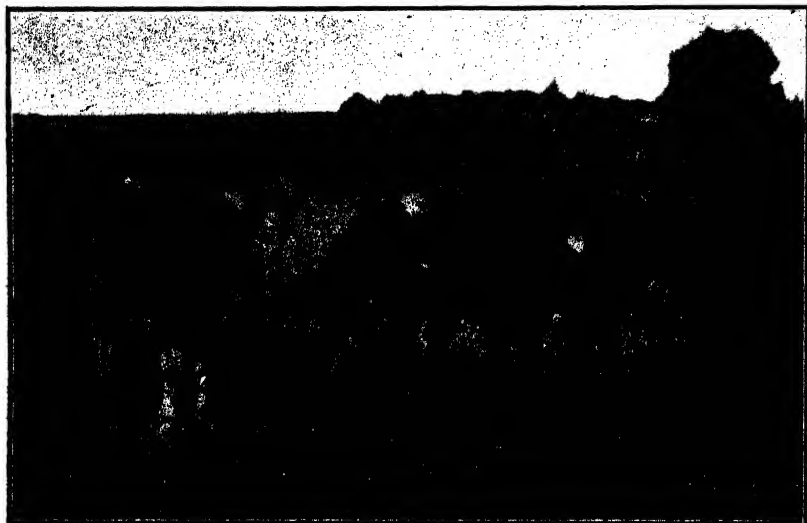
J. L. BRUCE, Superintendent of Experimental Farms.

THE present development of the dairy industry in New Zealand on lines which absorb the whole of the milk or involve the extraction of practically all feeding-matter therefrom is bringing about a position which threatens both dairying itself and beef-production. The rearing of calves is now one of the main problems confronting our dairy-farmers. Increasingly deprived of skim-milk and even ordinary whey, it has become more and more necessary to turn to other foods. The present high prices of such feeding-stuffs, if all purchased outside, may make rearing with their aid comparatively expensive; but a great many more dairy-farmers could and should grow the necessary crops, such as oats, linseed, and beans, for use on the farm. The dairyman must consider his future herd, and as a rule it will be sound economy for him to save and rear well at least his best heifer calves. The ordinary run of calves could also be profitably reared by the system of feeding here dealt with, but in their case the rearing seems likely to develop in the near future into a special and separate business on large-scale lines.

With the object of obtaining reliable local data as to what extent supplementary foods (mainly home-grown) can be profitably substituted for milk and whey, a scheme of feeding-tests, combined with the best practice in calf-rearing generally, was undertaken at the Department's experimental farms during the past season. In each case sixteen calves, most of which would otherwise have been slaughtered for their skins, were purchased soon after birth, divided into four groups of four each and fed strictly on the respective dietary assigned to each group, the period of the test being seventeen weeks. The results of the tests, as recorded in the matter which follows, are instructive, and go to show that the produce of the dairy can be very largely eliminated from the dietary of calves. There have been no deaths, and at the time of writing the calves are in excellent health and compare well with others reared mainly on milk.

Referring to the cost debited to each food in the several groups, these items may be regarded as average values current at the period of the tests, and are, of course, subject to variation according to circumstances. Farmers can readily work out costs in their own case on a similar basis.

In regard to general rearing practice, the writer is more than ever convinced that the *ancient calf-paddock* has been responsible for more ailments in cattle than possibly any other cause. It is essential that it be abolished and replaced by clean new grass pasture, preferably limed when sown down—no matter what the dietary of the calve may be.



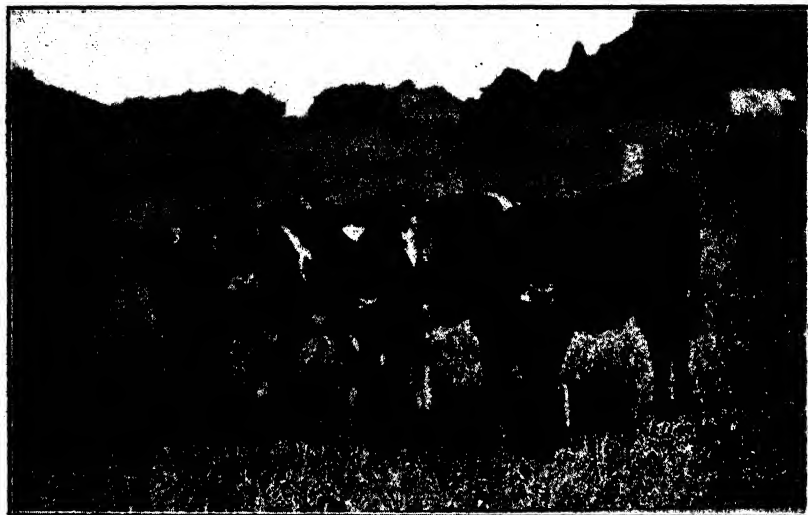
RUAKURA GROUP 1.

Whole milk, 8 lb. per day for two weeks; whole linseed 8 oz., flour 2 oz., plus skim-milk 15 lb., per day for fifteen weeks. Average daily gain per calf, 1.61 lb.



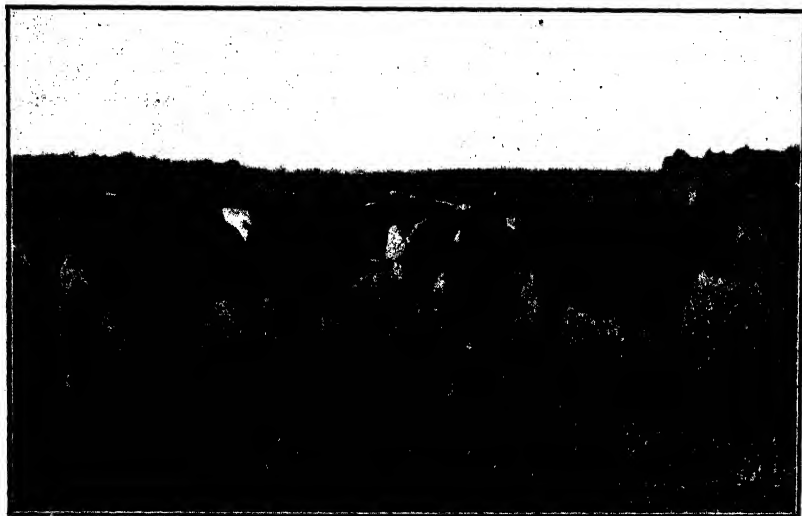
RUAKURA GROUP 2.

Whole milk, 8 lb. per day for two weeks; linseed-meal 7½ oz., bean-meal 12 oz., plus skim-milk 8 lb., per day for two weeks, after which skim-milk discontinued and water substituted for thirteen weeks. Average daily gain per calf, 1.36 lb.



RUAKURA GROUP 3.

Whole milk, 8 lb. per day for two weeks; oatmeal 8 oz., crushed linseed 4 oz., plus skim-milk 15 lb., per day for fifteen weeks. Average daily gain per calf, 1.54 lb.



RUAKURA GROUP 4.

Whole milk, 8 lb. per day for two weeks; crushed linseed 9 oz., plus skim-milk 15 lb., per day for fifteen weeks. Average daily gain per calf, 1.77 lb.

THE RUAKURA TESTS.

The following are particulars of the tests conducted at the Ruakura Farm of Instruction, Hamilton:—

The calves comprised sixteen non-pedigree heifers under one week old, purchased in the public saleyards at a cost of a few shillings each. These represented the ordinary-grade stock that came into the market. The calves consisted of twelve Shorthorns and four Shorthorn-Jersey crossbreds.

All calves were weighed on the same day, and then divided into four groups according to weights. The variation in the total weights for the four groups was only 2 lb., so that all lots commenced practically at the same mark. In making up the groups one Shorthorn-Jersey crossbred was placed in each group, this being the lightest calf in each group.

A shed was provided for shelter at nights for the first month. The animals were fed three times daily in separate bails. They had a clean run on to fresh pasture, a field of Western Wolth's rye-grass and red clover sown the previous autumn being set aside for this purpose. Clean drinking-water and a salt lick were within reach of the calves. All ran together in the same field during the day, and were housed in the same shed at night.

The calves when purchased were given one tablespoonful of castor-oil, and all fed on new milk for the first two weeks. At the end of the fortnight the four lots were placed on the dietaries set forth in the following statements, which also give details of gains, &c., for each group:—

Group 1.

Feeding formula: Whole milk, 8 lb. per day for two weeks; whole linseed 8 oz., flour 2 oz., plus skim-milk 15 lb., per day for fifteen weeks.

Preparation: Whole linseed soaked overnight in water and boiled for twenty minutes next day; flour mixed with a little water and added five minutes before boiling completed.

Weights and gains: Four calves—91 lb., 74 lb., 73 lb., and 63 lb.: total first weight, 301 lb.; total final weight (seventeen weeks), 1,071 lb.; total gain, 770 lb.; average daily gain of each calf, 1.61 lb.

Quantities and cost of food per head: Whole milk, 112 lb. = 4.2 lb. butterfat at 1s. 7d. per pound, 6s. 8d.; whole linseed, 52½ lb. at 3d. per pound, 13s. 1½d.; flour, 13½ lb. at 15s. per 100 lb., 2s.; skim-milk, 157½ gallons at 1d. per gallon, 13s. 1½d.: total cost of food per head for period of test, £1 14s. 11d.

Group 2.

Feeding formula: Whole milk, 8 lb. per day for two weeks; linseed-meal 7½ oz., bean-meal 12 oz., plus skim-milk 8 lb., per day for two weeks, after which the skim-milk was discontinued and water substituted during the remainder of the test (thirteen weeks).

Preparation: Boiling water, 30 quarts, added to 3 quarts of linseed-meal and 4 quarts of bean-meal, the whole covered up for twenty-four hours.

Weights and gains: Four calves—90 lb., 74 lb., 73 lb., and 65 lb.: total first weight, 302 lb.; total final weight, 952 lb.; total gain, 650 lb.; average daily gain of each calf, 1.36 lb.

Quantities and cost of food per head: Whole milk, 112 lb. = 4.2 lb. butterfat at 1s. 7d. per pound, 6s. 8d.; linseed-meal, 49 $\frac{7}{8}$ lb. at 3d. per pound, 12s. 3 $\frac{1}{2}$ d.; bean-meal, 72 $\frac{1}{2}$ lb. at 1d. per pound, 6s. 0 $\frac{1}{2}$ d.; skim-milk, 11 gallons at 1d. per gallon, 11d.: total cost of food per head for period of test, £1 8s. 11d.

Group 3.

Feeding formula: Whole milk, 8 lb. per day for two weeks; oatmeal 8 oz., crushed linseed 4 oz., plus skim-milk 15 lb., per day for fifteen weeks.

Preparation: Oatmeal 2 parts, crushed linseed 1 part, made into a porridge and mixed hot with skim-milk.

Weights and gains: Four calves—88 lb., 79 lb., 69 lb., and 67 lb.: total first weight, 303 lb.; total final weight, 1,036 lb.; total gain, 733 lb.; average daily gain of each calf, 1.54 lb.

Quantities and cost of food per head: Whole milk, 112 lb. = 4.2 lb. butterfat at 1s. 7d. per pound, 6s. 8d.; oatmeal, 52 $\frac{1}{2}$ lb. at 3d. per pound, 13s. 1 $\frac{1}{2}$ d.; crushed linseed, 26 $\frac{1}{2}$ lb. at 3d. per pound, 6s. 7d.; skim-milk, 158 gallons at 1d. per gallon, 13s. 2d.: total cost of food per head for period of test, £1 19s. 6 $\frac{1}{2}$ d.

Group 4.

Feeding formula: Whole milk, 8 lb. per day for two weeks; crushed linseed 9 oz., plus skim-milk 15 lb., per day for fifteen weeks.

Preparation: Dry crushed linseed stirred into the skim-milk immediately before feeding.

Weights and gains: Four calves—81 lb., 81 lb., 72 lb., and 67 lb.: total first weight, 301 lb.; total final weight, 1,148 lb.; total gain, 847 lb.; average daily gain of each calf, 1.77 lb.

Quantities and cost of feed per head: Whole milk, 112 lb. = 4.2 lb. butterfat at 1s. 7d. per pound, 6s. 8d.; crushed linseed, 59 $\frac{1}{8}$ lb. at 3d. per pound, 14s. 9d.; skim-milk, 158 gallons at 1d. per gallon, 13s. 2d.: total cost of food per head for period of test, £1 14s. 7d.

Notes on Results.

From the foregoing it will be seen that the dry crushed linseed added to skim-milk gave the highest daily increase in weight. This ration requires no preparation, and consequently entails the least labour. The calves carried good condition throughout, but did not have the fine glossy skins that were seen in group 3. There is not the least doubt that the oatmeal and crushed-linseed porridge gave the calves a better appearance, and this can be noticed in the accompanying photographs of the various groups.

When changing calves from milk to bean and linseed meals and water a considerable amount of difficulty was experienced in getting the calves to take the latter preparation, and for a few days a little skim-milk had to be added to make the change more gradual. Throughout the experiment the calves did not take this ration readily. It was



WERAROA GROUP 1.

Whole milk, 8 lb. per day for two weeks; skim-milk, 16 lb. per day for two weeks; flour 4 oz., and linseed-meal 3 oz., per day for thirteen weeks. Average daily gain per calf, 1.5 lb.



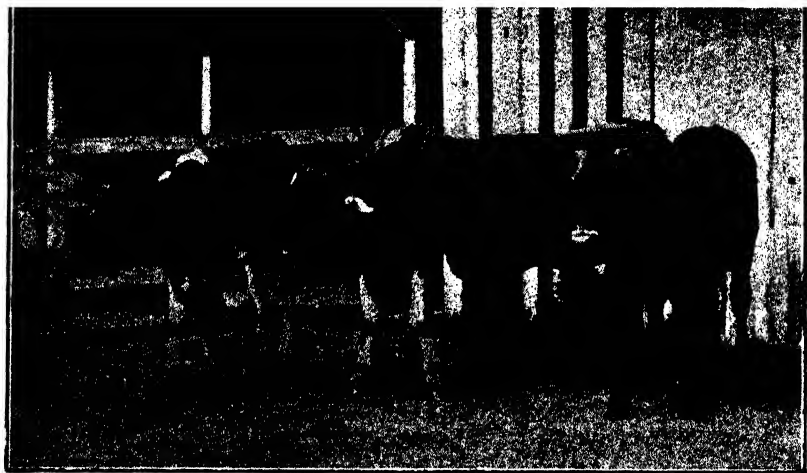
WERAROA GROUP 2.

Whole milk, 8 lb. per day for two weeks; skim-milk, 16 lb. per day for two weeks; crushed oats, 1 lb. per day for thirteen weeks. Average daily gain per calf, 1.7 lb.



WERAROA GROUP 3.

Whole milk, 8lb. per day for two weeks; skim-milk 16lb., plus 1 quart linseed-gruel, per day for fifteen weeks. Average daily gain per calf, 1.6lb.



WERAROA GROUP 4.

Whole milk, 8½ lb. per day for one week; skim-milk, 16lb. per day for one week; bean-meal 8oz., linseed-meal 6oz., cooked and fed with 3 quarts warm water, per day for fifteen weeks. Average daily gain per calf, 2.3 lb.

found that this food when prepared would not keep sweet like the other foods, and after twenty-four hours had a sour smell. On this season's experience bean-meal has proved unsatisfactory.

It is desirable to stress upon all those who wish to rear calves successfully, and at the lowest cost, the importance of clean fields and pastures, clean drinking-water, cleanliness in and around the feeding-yards and bails, and regular and proper methods of feeding. It is useless to attempt to rear calves if these important facts are ignored. The success of the trials at Ruakura was determined to a large extent by the ideal conditions under which the calves were kept. It was observed that calves of superior breeding and receiving better feeding, but kept on old pasture and in close proximity to cow sheds and yards, did not thrive to the same extent as those included in this experiment.

THE WERAROA TESTS.

Particulars of the tests conducted at the Central Development Farm, Weraroa, are as follows:—

Group 1.

Feeding formula : Whole milk, 8 lb. per day for two weeks ; skim-milk, 16 lb. per day for two weeks ; flour 4 oz., and linseed-meal 3 oz., per day for thirteen weeks.

Preparation : Linseed soaked overnight in $2\frac{1}{2}$ pints water, boiled next day for twenty minutes, adding flour (which has been previously mixed to a smooth paste with cold water) five minutes before boiling completed.

Weights and gains : Four calves—68 lb., 70 lb., 62 lb., and 61 lb. : total first weight, 261 lb. ; total final weight (seventeen weeks), 979 lb. ; total gain, 718 lb. ; average daily gain of each calf, 1·5 lb.

Quantities and cost of food per head : Whole milk, 112 lb. = 4·2 lb. butterfat at 1s. 7d. per pound, 6s. 8d. ; skim-milk, $23\frac{1}{2}$ gallons at 1d. per gallon, 1s. 11½d. ; flour, 26 lb. at 15s. per 100 lb., 3s. 11d. ; linseed, 19 lb. at 3d. per pound, 4s. 9d. : total cost of food per head for period of test, 17s. 3½d.

Group 2.

Feeding formula : Whole milk, 8 lb. per day for two weeks ; skim-milk, 16 lb. per day for two weeks ; crushed oats, 1 lb. per day for thirteen weeks.

Preparation : Crushed oats fed dry.

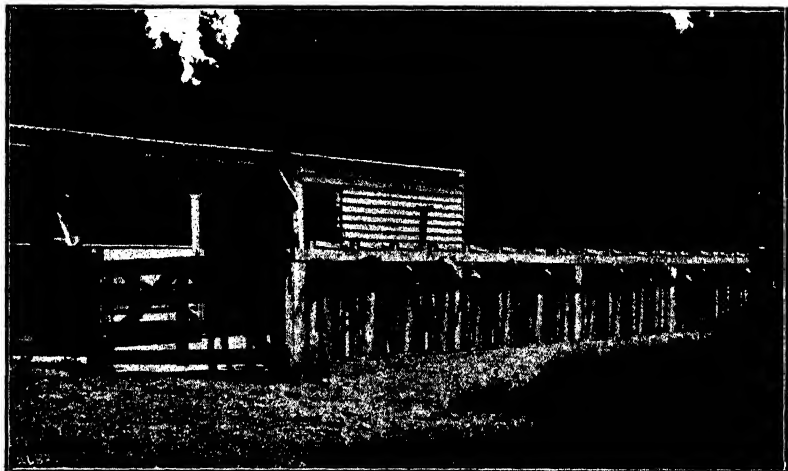
Weights and gains : Four calves—79 lb., 77 lb., 64 lb., and 60 lb. : total first weight, 280 lb. ; total final weight, 1,102 lb. ; total gain, 822 lb. ; average daily gain of each calf, 1·7 lb.

Quantities and cost of food per head : Whole milk, 112 lb. = 4·2 lb. butterfat at 1s. 7d. per pound, 6s. 8d. ; skim-milk, $23\frac{1}{2}$ gallons at 1d. per gallon, 1s. 11½d. ; crushed oats, 91 lb. at 4s. 6d. per bushel, 11s. 3d. : total cost of food per head for period of test, 19s. 10½d.

Group 3.

Feeding formula : Whole milk, 8 lb. per day for two weeks ; skim-milk 16 lb., plus 1 quart of linseed-gruel, per day for fifteen weeks.

Preparation : $\frac{1}{4}$ lb. linseed in 1 quart of water, boiled to a jelly.



THE TEST CALVES AT RUAKURA BAILED UP FOR FEEDING.



REAR VIEW OF SAME, SHOWING CONCRETE YARD.

Weights and gains: Four calves—68 lb., 70 lb., 60 lb., and 64 lb.: total first weight, 262 lb.; total final weight, 1,032 lb.; total gain, 770 lb.; average daily gain of each calf, 1·6 lb.

Quantities and cost of food per head: Whole milk, 112 lb. = 4·2 lb. butterfat at 1s. 7d. per pound, 6s. 8d.; skim-milk, 168 gallons at 1d. per gallon, 14s.; linseed-meal, 26½ lb. at 3d. per pound, 6s. 7d.: total cost of food per head for period of test, £1 7s. 3d.

Group 4.

Feeding formula: Whole milk, 8½ lb. per day for one week; skim-milk, 16 lb. per day for one week; bean-meal 8 oz., linseed-meal 6 oz., well cooked and fed with 3 quarts of warm water, per day for fifteen weeks.

Preparation: Boiling water 30 quarts, added to 3 quarts of linseed-meal, plus 4 quarts of bean-meal, the whole mixed and covered for twenty-four hours.

Weights and gains: Four calves—71 lb., 75 lb., 70 lb., and 62 lb.: total first weight, 278 lb.; total final weight, 1,355 lb.; total gain, 1,077 lb.; average daily gain of each calf, 2·3 lb.

Quantities and cost of food per head: Whole milk, 60 lb. = 2·25 lb. butterfat at 1s. 7d. per pound, 3s. 7d.; skim-milk, 12 gallons at 1d. per gallon, 1s.; bean-meal, 52½ lb. at 1d. per pound, 4s. 4½d.; linseed-meal, 39½ lb. at 3d. per pound, 9s. 10½d.: total cost of food per head for period of test, 18s. 10d.

Notes.

The calves used for the Weraroa tests were crossbreds, comprising Friesian-Jersey, Shorthorn-Jersey, Ayrshire-Jersey, Friesian-Shorthorn, and Guernsey-Jersey, also grade Jersey.

The substitution of the various foods which finally replaced the milk ration was brought about gradually. Thus, before the end of the new-milk period a little skim-milk was introduced, and increased until the ration was all skim. Other food changes were made similarly, and the animals at no time suffered any check.

It was clearly demonstrated throughout the tests that the most important and essential factors in calf-rearing (apart from the dietary) were (1) a clean new grass-paddock, (2) a good supply of fresh drinking-water, and (3) clean feeding-utensils. There is no doubt that the absence of scour among the calves was largely due to the latter precaution.

Sore Hands after Concrete-work.—A Dannevirke correspondent writes: "When working with concrete, cement, or lime one's hands are apt to get dry and sore. For some years past I have found the following treatment to give sure relief. As soon as possible after work is finished get a basin of warm water, and with soap work up a good lather on the hands. Then take a teaspoonful of sugar among the lather, and work it into the hands and finger-nails for a minute before rinsing. The hands will then be quite clean and all soreness gone.

WEEDS AND THEIR IDENTIFICATION.

(Continued.)

E. H. ATKINSON, Biological Laboratory.

LANTANA (*LANTANA CAMARA* L.).

By Order in Council gazetted on 27th November, 1919, the subject of this article was added to the Third Schedule of the Noxious Weeds Act—*i.e.*, it is a noxious weed when so declared by the local authority. The accompanying description and illustration are presented with the object of making the plant more readily recognizable by farmers and others who may happen to come across it.

DESCRIPTION.

Lantana Camara is a tall rambling shrub reaching an extreme height of 10 ft. or so. The branches, which are brittle, are decidedly four-angled, and are usually armed with numerous short, strong, recurved prickles, borne only at the angles of the stems. As a rule—though this is a variable character—the whole surface of the branchlets is covered with short stiff hairs, which are particularly abundant towards the young tips.

The leaves, too, are hairy, especially in the case of the under-surfaces of the newly developed ones, where the hairy covering is often so thick as almost to form a felt. In outline they are ovate (egg-shaped) or even slightly heart-shaped at the base, with a somewhat gradually tapering tip. The edge of the leaf is cut into numerous rather blunt teeth, which are less conspicuous at its base. The leaves spring in opposite pairs from the stems, each pair being set at right angles to those above and below it.

The flowers are borne in small heads not unlike those of the garden verbenas only less than half the size, the heads themselves being carried on stalks which arise from the axils of the upper leaves. These stalks are at first short, but elongate considerably as flowering progresses, so that the younger flower-heads are often overtopped by the older ones. The individual flowers, which grow out from between short and narrow hairy bracts, are small—from $\frac{1}{4}$ in. to $\frac{1}{2}$ in. in length—tubular in shape, spreading above into four rather irregular lobes, and in colour pink, or in some forms yellow or orange, turning later to red.

The fruit is berry-like, about $\frac{1}{2}$ in. in diameter, dark-coloured, and very juicy when fresh.

All parts of the plant, particularly the leaves, have a strong and rather pleasant scent.

DISTRIBUTION.

Lantana belongs to a family which comprises several plants well known both in gardens and in the wild state in New Zealand, among the former being the gaily-coloured verbenas, while among the wild plants the puriri, in the North, is one of the best known and most valuable of native trees. The genus *Lantana* has its headquarters in tropical and subtropical America, and it is from thence that



LANTANA CAMARA.

Flowering and fruiting branch, about half natural size.

[Drawing by E. H. Atkinson.]

L. Camara (the species under consideration) has spread widely in various warm countries, including Ceylon, many of the Pacific islands, and the northern parts of Australia and New Zealand.

In this Dominion, as far as is known, lantana is at present practically confined to the country adjoining the Hokianga River and Harbour, where it was first recorded twenty-five years ago. It is particularly abundant at Kohukohu, on the northern waterfront of the harbour. Mr. J. W. Otway, Stock Inspector, Ohaeawai (whose assistance in supplying material has been invaluable), reports as follows: "As regards the spreading of lantana, although there are some acres of it in and around Kohukohu it does not seem to be spreading very fast, as it seems to prefer the covered country. I found plenty of seedlings in the bush reserve at Kohukohu, but out on the open grass-country, except for a few scattered bushes, I did not find any. The bushes, although large, do not seem to be thriving. I did not see any evidence that either frost or stock touch it in any way." Lantana has also been reported from the Northern Wairoa, but information as to this habitat is somewhat vague.

Though lantana occupies immense areas in some of the countries previously mentioned, the present economic position of the plant in the Dominion is one of minor importance only, its inclusion in the Noxious Weeds Act having been thought advisable chiefly on the evidence of its aggressiveness elsewhere under conditions not altogether dissimilar to those obtaining in the north of New Zealand.

In Queensland and New South Wales it has overrun many of the river scrubs and become a well-known pest, though it is considered to be not without redeeming qualities, owing to its fallowing properties and because the leaves form a mulch for the ground. As regards the injuriousness of the plant to stock, Mr. J. H. Maiden, F.R.S., Government Botanist of New South Wales, writes: "We have two forms of the species, the common pink-flowered form and a form with orange-coloured flowers, chiefly found on the northern rivers, and also in Queensland. It is the second kind which is accused of causing "pink-nose" in cattle in northern Queensland." I have not heard of the common lantana being noxious to stock in New South Wales, though occasionally in a droughty season one hears words to that effect, but without any details that one can follow up." The pink-flowered form seems to be the one found in New Zealand, and as no reports have been received of stock eating it here no trouble need be anticipated in this direction.

It should be mentioned that F. M. Bailey, in "Weeds and Suspected Poisonous Plants of Queensland," states that children have frequently been made ill from eating the fruit.

The position in regard to lantana in New Zealand may be summed up as follows: The plant has been naturalized for at least a quarter of a century in North Auckland and during that time has spread quite slowly. Were it not for the plant's bad reputation elsewhere it is therefore probable that but little attention would have been called to it. At the same time it would be unwise to disregard altogether the possibilities of the plant as a weed, and the Department would be grateful for any fresh information as to its occurrence in habitats other than those here mentioned, and also as to its behaviour under various conditions of environment.

MILK AND CREAM FOR FACTORY SUPPLY.

(Concluded.)

G. M. VALENTINE, Dairy Instructor, Auckland.

WASHING-UP OPERATIONS.

WASHING-UP is a simple matter if gone about in the right way, which is to do it as soon as milking is finished. If proper conveniences are provided it takes less time to do the work well than to half do it, because in such case the utensils are never allowed to get really dirty. A good set of brushes, an ample supply of hot water, and one or two tubs are required. Rags for washing dairy utensils are quite useless. They do not get into the corners, and are frequently allowed to get so foul as to be a hotbed for the propagation of germs. First rinse with cold water everything with which the milk comes in contact. Then scrub thoroughly in warm water in which some soda or other cleanser has been dissolved. Lastly, scald in boiling water.

Tinware treated in this manner will look bright and new after years of use, as the heat of the boiling water will dry it off at once and prevent the formation of rust. Contrast this with utensils washed in cold water only. The tinware has a dull, black appearance, and if rubbed with the fingers a greasy smudge appears. A yellow deposit of stale milk will usually be found in the seams, and rust soon makes its appearance. Milk or cream from such a dairy cannot be expected to reach the factory in good order, as they are contaminated before they leave the farm.

It is not necessary to scour dairy utensils with Bath brick, sand-soap, or metal-polish. It is, indeed, a great mistake to do so, as it removes the coating of tin from the steel of which the so-called tinware is made, and causes it to rust. If it is desired to give tinware an extra good scouring, dip a damp brush in some cleansing-powder which is not of a gritty nature.

Where whey is taken home in the cans it should be emptied at once on arrival, and special attention given to the washing.

THE SEPARATOR.

Leaving the separator overnight without washing is a dirty practice, and is altogether too common. By "washing" is meant taking to pieces and washing in the proper way, not merely running some water through when separating is finished. In the latter case the deposit of slime and dirt which remains in the bowl even in the cleanest dairy is left steeping in water all night, with the result that a plentiful crop of germs is developed to contaminate the milk which goes through the separator next morning. The supplier who would not dream of using a bucket which was as dirty as the separator-bowl will not hesitate to use the separator without washing it.

There is no saving of time by leaving the separator unwashed overnight, as, owing to the milk being dried on, it will take longer to wash

it next morning. This practice is also a direct loss to the supplier. The separator is designed to exert a certain amount of centrifugal force on the milk, and the diameter and speed of the bowl are worked out on lines which ensure the best results in skimming. As the amount of dirt in the bowl increases the diameter decreases, and the loss of fat in the skim-milk increases accordingly. This could be carried on to the point where the milk is not separated at all and the whole bowl is choked. Obviously, if the bowl starts in the morning with an accumulation of dirt the loss in skimming must be greater than if starting with a clean bowl. Then the supplier will find that no matter how he alters his cream-screw he cannot get his test up. Needless to say, cream from a separator treated in this way is poor in flavour.

The washing of the separator is not complete until the frame has been wiped over with a damp cloth, benches washed down, and the floor of the separator-room thoroughly scrubbed. If possible, place the tinware where the sun shines directly on to it.

THE MILKING-MACHINE.

The easiest way to keep a milking-machine clean is to prevent it ever getting dirty. This is comparatively easy if it is properly washed from the first time of using. The secret lies in doing so as soon as milking is finished, before the milk dries on. If the machine is allowed to get really dirty washing is a very difficult matter indeed.

The casein in milk is one of the strongest adhesives known, which is the reason of its value for making paints, glues, &c. It is therefore very difficult to remove the casein once it has got into milk-pipes. No milking-machine can be washed in a few minutes, as sometimes stated by energetic salesmen. The story that the releaser need only be taken down every three months, that the vacuum-tank does not require attention, and that the air-system has nothing to do with the milk, has been exploded long since. A regular system of cleaning should be laid down and followed, and very little trouble will then be experienced in supplying milk and cream of good quality.

Immediately milking is finished draw some cold water through all the milk-pipes. Remove teat-cups and milk-tubes, then draw some hot-water cleanser through the down-drops into the releaser. Run a wire brush through the down-drops, rubber connections, and taps. Brush the overhead milk-pipe by passing through it a brush attached to a line. The vacuum will carry the brush into the pipe, and it can be drawn back and forth with the line. Then take some boiling water and draw it through the pipes until they are heated right through to the releaser. Place teat-cups and milk-tubes in a tub, and pass the brush through all the parts with which the milk comes into contact. Wash the dirt from the outside, rinse in clean water, and scald in boiling water.

The scalding is the most important part of the washing-up, and if done properly there will be little trouble with milking-machine flavour. The object of scalding is to kill the germs, and make the pipes so hot that they will dry off and leave no damp spots in which germs can develop before next milking. It is not uncommon to find that pipes which have been left damp have been fly-blown between milkings. If only hot water is available it cools before it gets half-way through the

machine, and is consequently of little value. Some machine-users make the objection that the boiling water cracks the sight-glasses; but these can be replaced with celluloid. Others say that it spoils the rubbers. The worst enemy of rubber is grease, and the hotter the water the less likelihood is there of grease getting into the rubber.

It is necessary to take down and wash the releaser every day, a simple matter with present-day releasers. The lid of the vacuum-tank should be removed daily, and the tank scrubbed out at least once a week. Take to pieces the whole of the inflation, claws, milk-tubes, down-drops, and overhead milk-pipes twice weekly, and scrub them with the brushes supplied for the purpose. Boil all milk-tubes, except the inflations, for fifteen minutes once weekly in water to which some soda has been added. This will get rid of the grease and preserve the rubbers. In some cases the latter have been in use for five years with this treatment. If boiled in a kerosene-tin place the rubbers in a sugar-bag, so as to keep them off the bottom of the tin, where they would come in contact with the flames.

Any dullness in the metal pipes of a milking-machine is an indication that they are dirty. It is a common experience to come across machines in which the overhead pipe is as bright as a new gun-barrel, while the down-drops are very dirty. This is because of the regular practice of putting the brush through the large pipe only. The rubber connection between the down-drop and the overhead pipe is another frequent cause of trouble. Judging by the difficulty in getting it off, it is never removed in some sheds.

After scalding, place the teat-cups and tubes in a tub of clean water to which some cleanser, salt, limewater (not dry lime), permanganate of potash (very weak), or similar preparation has been added. This water must be renewed daily, or it will do more harm than good. It can be used to wash down the floor of the shed each morning. Nothing could be worse than the filthy mixture resulting from the practice of putting dirty teat-cups (which have fallen on to the floor during milking) into a tub of fluid several days old. In such case the cups are taken out with more or less of the liquid adhering to the inside of the inflations and milk-tubes, and when the machine is started it is drawn into the milk. With machines having only one pipe for both air and milk any of this liquid which has got in between the inflation and the teat-cup will also be drawn into the milk through the air-tubes.

Where separate air and milk systems are provided, the air-pipes frequently become foul. Cases have occurred where the automatic pulsator has refused duty as the result of an accumulation of dirt in these pipes. A broken inflation will have the same result, and when this happens the pipes should be at once flushed out in the same way as the milk-pipes. In ordinary practice this should be done every week, and will keep the pipes clean up to the vacuum-tank.

The pipe from the releaser to the vacuum-tank and thence to the pump is a source of infection in a great many dairies. It is very seldom washed, and soon gets dirty with the condensation of the milk-vapour. It is a hard matter to convince many dairy-farmers that this pipe has any influence on the quality of the milk, as the suction is all towards the pump. The number of cases in which taints have disappeared after this pipe was attended to, however, leaves no room for argument

on this point. If unions and rubber joints are provided it is an easy matter to take the pipe down and wash it out. When the air-pipes have got into a very dirty state the only way to thoroughly clean them is by burning them in a fire, when hammering on the outside will remove the scale. If drawn-brass pipes are erected in the first instance very little trouble will be experienced in keeping them clean, and if they should happen to get dirty it is an easy matter to wash them out with a brush and hot water. The vacuum-pump must also receive its share of attention, as it gets just as dirty as the air-pipes. Finally, dairymen should remember that for cleaning a milking-machine no cleanser has yet been discovered which will take the place of hard work and boiling water.

THE MILKING-SHED.

Cleanliness in the shed is a matter in many cases which does not receive the attention it deserves. Like all other things in the dairy, it is an easy matter to keep a shed clean if the work is done regularly. With an ample water-supply and a concrete floor it is only a matter of minutes to wash the whole place out. A wooden floor is difficult to keep clean. With clay or metal it is almost impossible to keep the floor as it should be, though a sprinkling of slaked lime after cleaning will help to keep down any offensive smell.

The manure-heap should not be any closer than 30 ft. from the opposite end of the shed to the separator-room. All doors should be left open between milkings, so as to give free play to the wind and allow as much sun into the shed as possible. A coating of limewash once a year will improve the appearance of the shed and assist in keeping down disease in the herd.

GENERAL.

The objection may be made that if everything here detailed is carried out it will be one person's work to look after the machines and dairy. If left to one person, that is quite true, but it is the only way in which quality, which is the foundation of the whole dairy business, can be maintained. The same may be said of the work of washing up in a factory, but no one would suggest that it should be neglected because it takes a lot of time. Thousands of dairymen are working every day on the lines indicated, and they are the men who are holding up the reputation of our butter and cheese. Generally speaking, these are the men who are afraid that they are not doing as much as they should and are always on the lookout for hints as how to do better.

CREAM-GRADING.

It is estimated that about 10 per cent. of the milk and cream received at our factories is choice, 80 per cent. fair, and the balance poor. With the exercise of a little more care the great bulk of that 80 per cent. could be raised to choice quality. In a great many cases the reason why that extra care is not taken is that no more will be received as a result. Virtue as its own reward does not appeal to the average dairyman.

Cream-grading has been carried out in several districts in the Dominion for the past few years, but grading of milk has not been

attempted. There seems to be no reason why milk should not be graded as well as cream. The defects may not be so apparent in fresh milk as in cream which is two days old, but cheesemakers will hardly admit that they are poorer judges of quality than buttermakers. They usually know whose milk to use when making show cheese, and have the advantage of the curd-test to verify their judgment.

There is nothing mysterious or impossible in the production of first-class milk and cream, though circumstances may make it more difficult in some cases than in others. All that is required is strict cleanliness and proper cooling; the bulk of the bad cream received is the result of neglect of these two points. The quantity which is defective from other causes is very small indeed, and a little investigation on the spot will usually locate these causes.*

Among objections made to the grading of cream is the argument that the supplier who lives at a distance from the factory is placed at a disadvantage. Experience has shown that this is not the case, as suppliers so situated frequently send in the best cream received. This is no doubt due to the fact that owing to their position extra care is taken, while the nearby supplier thinks that, being so close, no care is necessary. The fact is that good cream takes a lot of spoiling, but bad cream is spoilt before it leaves the farm. Another objection is that cream that is good when it leaves the farm may be spoilt as the result of the treatment it receives on the road. This is not likely, and only shows that such defects in transit have been noticed by the supplier, but he has not been sufficiently interested to get busy and have them remedied.

Then there is the threadbare excuse of feed flavours, usually advanced by the man who has never used a cooler and stirrer. Generally speaking, feed flavour is looked upon as a defect which cannot be helped, and that therefore it should not be graded down. Cream is graded down not because of the flavour which it contains but because of the flavour it imparts to the butter made from it. Whether the flavour is preventable or not does not enter into the question, as that point is not considered by the butter-buyer. Even feed flavour may be largely controlled. Turnip flavour seems to be largely a matter of care in feeding; if the roots are pulled a day or two before feeding and the feeding not overdone no great harm seems to result, provided proper attention is paid to the care of the cream. The onus of supplying a good cream while feeding turnips is on the supplier, and though they may be the cause of a bad flavour that cannot be accepted as an excuse for it. Again, with *Lotus major* pasture, flavour may be overcome by consistent cooling. The writer met with a case of trouble from this cause in which the night's cream was first grade and the morning's cream second grade. Inquiries showed that the

* In possibly 1 per cent. of cases no reason can be found for a defect even on the closest investigation. In such a case pasteurizing the cream on the farm will usually prove successful; but this is really a last resource, and not to be recommended except in extreme cases. Great care must be taken, or more harm than good will be done. Place the can containing the cream in a copper of water, and bring the temperature of the cream up to about 150° F. Hold it at that temperature for about ten minutes, then cool as rapidly as possible. If there is only a small quantity it may be mixed and treated once daily, but in no case must the cream be placed directly on the fire.

morning's cream had not been cooled, hence the strong feed flavour and consequent second grade. This was clearly a case where feed flavour was the cause, but no excuse for the second grade. Grading combined with instruction on the farm is now being carried out at a number of factories with very satisfactory results.

Until the year before last the cream was graded into two classes only—first and second grade—the difference in the corresponding price ranging from $\frac{1}{2}$ d. to 2d. per pound in various districts. Experience has shown that where $\frac{1}{2}$ d. only was deducted the difference in price was not sufficient to induce the careless supplier to improve.

GRADING ON POINTS.

During the last two years a step forward has been made by the adoption of the system of grading on points. The results have been so satisfactory that quite a number of factories are paying for cream on this system this season. Many others have adopted a modification of the same system by making a choice grade, for which $\frac{1}{2}$ d. extra is paid but no pointing is done. In the complete system the points are the same as those allotted in butter-grading—that is, under 88 points is second grade, 88 to 91 first grade, and 92 and over is choice. For this choice quality $\frac{1}{2}$ d. per pound more than for first grade is paid, while $\frac{1}{2}$ d. per pound less than for first grade is paid for second grade. For example, if 1s. 4d. is being paid for first grade 1s. 3 $\frac{1}{2}$ d. will be paid for second and 1s. 4 $\frac{1}{2}$ d. for choice quality. While the supplier of second-grade cream is not paid any less than before, the one sending in first grade has some reward, and the supplier who sends in choice quality is further paid for the extra care taken. The points, however, are not detailed under separate heads as in butter-grading, and there are no half-points.

The improvement in the quality of the cream supplied to those factories which have adopted this system has been very marked, and the quality of the butter made has improved correspondingly. Careful experiments have been made to test the system, and when the cream has been churned in the qualities as graded at the factories the results at the grading-stores have corresponded, except that second-grade cream has sometimes made third-grade butter. This system must appeal to any one having a knowledge of the business as being on right lines. Without pointing, the success which has followed the grading of butter and cheese could not have been fully attained. A grade-note which simply stated that the line of produce to which it referred had been classed first, second, or third grade would appeal to very few managers. Without such a system the 80 per cent. of suppliers who send in the bulk of our cream have no means of knowing whether they are just getting into first grade or just missing the choice score, and there is no particular inducement for them to find out. With a higher price attainable, however, there exists a good reason for improvement, and the natural result is an immediate search for the cause of any defect.

At those factories where the cream has been pointed but no difference made in the price very little good has been done, clearly showing that the higher price was the reason for the improvement at other factories. The spirit of rivalry aroused between suppliers is also not without its value, and in one factory a trophy has been provided for

competition among suppliers. The great point in the system, however, is that it lets every one know just where he stands.

The difficulty of getting competent graders has been brought forward as an objection by both managers and suppliers, and some managers have suggested that such men should first pass an examination. Butter and cheese graders have been recruited from the ranks of the factory-managers in the past, and competent cream-graders can be found among the factory employees, though for a time additional work may be thrown on to the managers and buttermakers in the large factories, as extra supervision will be necessary. As a matter of fact, the quality of each supplier's cream is well known to the men on the receiving-platform of every factory where an intelligent interest is taken in the work, especially when the old system of grading has been followed. Pointing is only putting it on a more businesslike footing.

It must be remembered that in butter and cheese grading the grade is first determined and the points awarded afterwards. In the same way, the cream-grader will first decide whether a cream is choice, first or second grade, and will then award the points to indicate to the supplier its position in the class in which it has been placed. The standard adopted at different factories may vary a little, but that does not materially affect the matter, as all the suppliers to one factory will be graded on the same standard. Cream-grading conferences held during the past season have shown very little variation in the standard adopted by different managers, and visits from the Department's Instructors also assist towards uniformity. Something on the same lines among factory employees can be instituted by managers, and the experience of those who have already tried this system is that it results in a very much keener interest in their work on the part of the men.

COMMERCIAL SOUNDNESS OF GRADING.

It has been stated that the payment of a premium for choice-quality cream is economically unsound under present marketing-conditions, as the equivalent is not received for the butter when sold. That is not so. The reputation of New Zealand dairy-produce is being maintained by those suppliers who send in the choice milk and cream, and the value of that reputation during the last three years in the case of butter has been 6s. per hundredweight. Roughly speaking, 6s. per hundredweight for butter is equal to $\frac{3}{4}$ d. per pound on butterfat, so that in paying the supplier $\frac{1}{2}$ d. per pound for choice cream he is not getting even as much as he is entitled to. There is another aspect to this question, and that is the competition which will have to be met when an open market is restored. Those factories which had to drop cream-grading for a time during the influenza epidemic know how the quality fell away and how difficult it was to raise it again, a clear indication of the necessity for constant watchfulness.

REMINDERS.

In conclusion, the following is a summary of the points which dairymen would do well to paste in a conspicuous place in the shed to serve as a reminder :—

Don't race the cows to the yard with a dog: it will cause cowy flavour in the milk.

Don't allow the cows to drink impure water.

Don't use the milk until the cow has been calved at least four clear days.

Don't start milking without first washing your hands.

Don't start milking until you have washed and dried the cow's udder and teats, using clean cloth, clean water, and a clean bucket.

Don't use milking-machines without drawing some water through first.

Don't allow fowls, calves, or pigs in the shed.

Don't use a cloth strainer without scalding it daily.

Don't use kerosene-tins for milk or cream.

Don't use a wooden stirrer for milk or cream.

Don't use a cloth for washing utensils.

Don't use the separator-room for a general storeroom.

Don't separate in the milking-shed.

Don't mix hot and cold cream together.

Don't keep cream in the same room as an oil-engine.

Don't put the lids on the cream-cans until just before sending them away.

Don't leave the cream standing in the sun.

Don't expect to keep the separator and milking-machine clean unless you have a proper set of brushes.

Don't make the state of your neighbour's dairy an excuse for neglecting your own.

Always cool the milk as soon as it is drawn.

Always cool the cream as it leaves the separator.

Always keep milk and cream in a pure atmosphere.

Always keep milk and cream stirred with a metal plunger.

Always distribute the night's milk over all the cans in use.

Always wash cans immediately they come back from the factory.

Always skim cream so that it contains not less than 40 per cent. of fat.

Always wash the separator every time it is used.

Always wash utensils in warm water and scald in boiling water.

Always wash the milking-machine with cold, warm, then boiling water.

Always wash the milking-machine immediately milking is finished.

Always take the releaser down for washing daily.

Always take the lid off the vacuum-tank daily.

Always take the milking-machine to pieces and wash thoroughly twice weekly.

Always boil the milk-tubes once weekly.

Always wash out the vacuum-tank.

Always remember that water boils at 212° F.

Ruakura Sale of Pedigree Stock.—At the first annual public sale of pedigree stock of the Ruakura Farm of Instruction, held last month, the following prices were realized: Milking Shorthorn bulls—highest £46 4s., average £25 15s. 3d.; Jersey bulls—highest £110 5s., average £59 17s.; Berkshire boars—highest £23 12s. 6d., average £12 2s. 3d.; Berkshire sows—highest £18 18s., average £13 12s. 6d.

PASTURE TOP-DRESSING TEST IN WAIPUKURAU COUNTY.

J. W. DEEM, Fields Instructor.

THE top-dressing experiment initiated by the Hawke's Bay Farming Development Association on the property of Mr. A. F. Cook, Farm Road, Waipukurau, in August, 1917, to ascertain if by top-dressing the better grasses would be stimulated and helped to hold their own against florin, also to learn the increase, if any, in the carrying-capacity of the land treated, was determined on 31st December last, after having run for two years and four months, Mr. Cook being desirous of breaking up the untreated area.

The first season of the test was fairly moist, but the last two were very dry, consequently the conditions could not be considered ideal for manures to show up to the best advantage. In fact, there were times during the last two years when the area was quite devoid of feed, and the stock had to be removed. An inspection of the area in April, 1920, showed the treated area to be much greener than the untreated area. There was also far more rye-grass to be seen in the treated area as compared with the untreated, showing that the top-dressing had the effect of stimulating the better grasses.

Surveying the results for the whole period, it is found that the first two years gave an increased carrying-capacity of $1\frac{1}{2}$ sheep per acre per year for the treated area, and at the rate of 1 sheep per acre for the remainder of the period of the experiment. If the cost of carrying a sheep is taken at 9s. per year the following results are arrived at: 1917-18 and 1918-19 seasons, $1\frac{1}{2}$ sheep at 9s., £1 11s. 6d.; 1919-20 season, 1 sheep at 9s.; total, £2 os. 6d.; against an expenditure of £1 10s. 5d. for manures*; profit per acre compared with the untreated area, 10s. 1d.

Had the different lines of sheep been weighed on and off the different areas, and the latter credited with the respective gains in meat and wool, there is no doubt that the top-dressed area would have shown a much greater profit. For instance, Mr. Cook reports that in March, 1918, forty two-tooth wethers were taken off the top-dressed area and sold for £1 9s. 8d., while none of those on the untreated area were fit for sale.

The experiment has given sufficient data to warrant further work in this direction. The association, however, should be sure of a large-enough area to test different top-dressing mixtures, also have complete control and secure possession for a period of from ten to twenty years.

* The following are details of the fertilizers used in the experiment: Japanese super, 141 lb.; Ephos phosphate, 112 lb.; bonedust, 28 lb.; dried blood, 28 lb.; total, 309 lb. of mixture per acre. The cost per acre (in 1917) was—fertilizers, £1 4s. 6d.; freight, 1s.; cartage, 1s. 5d.; harrowing, 1s. 6d.; drilling, 2s.; a total of £1 10s. 5d. For previous reports on the test see *Journal* for May, 1918, and November, 1919.

ORCHARD TILLAGE.

IMPLEMENTS AND THEIR USE.

T. E. RODDA, Manager of the Arataki Horticultural Station.

PLOUGHING AND DISKING.

IN the average orchard the soil should be ploughed at least twice a year. At the end of autumn the land should be turned over, and left in the furrowed state during the winter. The earth should be banked to the trees, and the land finished in the centre of each row. This ensures good drainage, and does not allow the stagnant water to collect near the base of the trees.

Various makes of ploughs are used for this purpose. One with a long head-rack or bridle and shiftable handles, either single or double furrow, such as the Harvey (an Australian-made plough), should be used in opening out. These ploughs are so constructed that the team and driver are clear of the spreading branches while the implement is turning the soil close in to the trunks of the trees. By turning the draught-chain and bridle to the reverse side the plough can be made to turn the earth away from the trees with corresponding ease. Such an implement greatly reduces the danger of barking the trunks and injuring the branches. Similar ploughs of American manufacture, such as the Oliver, the John Deere, and the Massey-Harris orchard and vineyard ploughs, are also recommended. They are somewhat lighter in draught and somewhat cheaper in price, but probably they do not wear so long as the Harvey. The use of special orchard harness also reduces the amount of branch injury, and I would advise any grower, large or small, to procure such gear: it will be money well invested. There are various makes of orchard harness on the market. Several makes were recently demonstrated at an orchardists' field-day at this station, those of Holden and Frost and Simpsons Harness Ltd. meeting with approval in the order named. When the soil is turned to a sufficient distance to ensure branch clearance, double- or single-furrow ploughs of ordinary make can be used, or the special orchard ploughs can be used until the whole orchard is completed.

At the approach of spring the land should be again worked, when weather conditions are favourable. In the case of light friable soils probably all that will be necessary at this season will be a thorough disking and harrowing, but in heavy soil it is advisable to give the land a stroke with the disks, and then plough it away from the trees. The following year all ploughing should be done at right angles to the previous furrows, so as to ensure all soil in the orchard being stirred by the plough periodically. After completing spring ploughing, the disk harrow should be again brought into use, and a portion of the soil returned towards the tree-trunks by using the implement as a cut-away. This is in order to obviate the danger of injury to the root-fibres by the drying influences of harsh winds, which are often prevalent at this time of the year. If the winds are exceptionally severe it is advisable to waste no time in working the soil back towards the roots.



FIG. 1. SINGLE-FURROW HARVEY PLOUGH TURNING FURROW FROM THE TREES.

Turning the first furrow after the work has been carried forward as far as possible with an ordinary double-furrow plough. Three furrows more can be cut without injury to the trees.



FIG. 2. FRONT VIEW OF SINGLE-FURROW HARVEY PLOUGH, SHOWING SIDE HITCH.

Horse equipped with Holden and Frost's orchard harness



FIG. 3. FRONT VIEW OF PLANET JR. SCARIFIER NO. 41, SHOWING HOW TEAM IS ATTACHED BY SIDE HITCH.

Centre of implement indicated by X between legs of off-side horse. Point of draught now 15 in. to left of centre. Note how close implement is forced in to butts of the trees while horse walks clear of limbs.

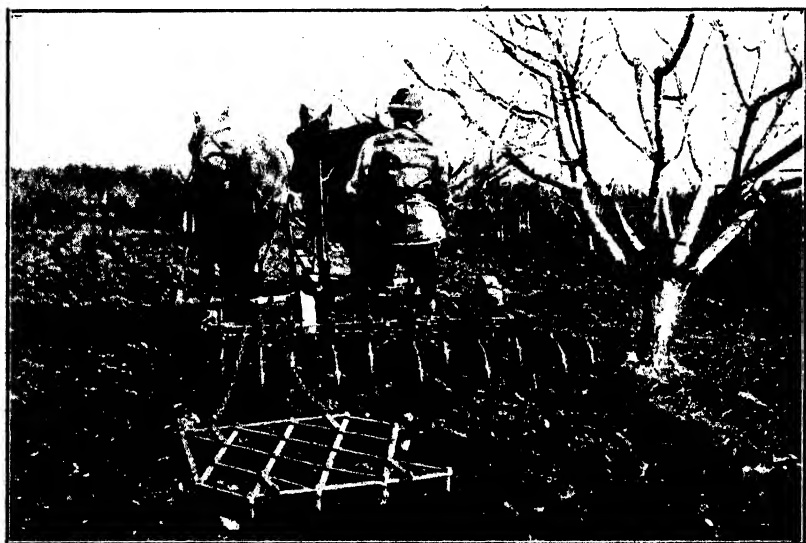


FIG. 4. REAR VIEW OF PLANET JR. SCARIFIER NO. 41, SHOWING METHOD OF ATTACHING HARROW TO COUNTERACT SIDE DRAUGHT.

Driver's seat is fair over centre of implement, while point of draught is 15 in. to left, where pole is attached.

An orchard disk should be so constructed that the gangs can be made to throw the earth towards the trees or draw it away from them, and the frame should be so designed that it is kept as low to the ground as possible, and allow the width between the gangs to be easily and readily altered when it is desired to do so. When fully extended one gang of disks will stir the soil close up to the trunks of spreading trees, while the horses are driven clear of the branches. There are numerous makes of orchard disks on the market, including the Barger, the Osborne, and the Harvey. They all work much on the same principle, and ensure effective cultivation, while the danger of tree-injury is reduced to a minimum if they are operated by a careful driver.

SCARIFIERS AND SCARIFYING.

During the growing-period, after spring disking, the soil should be stirred at least once a month with a scarifier, in order to prevent the growth of weeds and to retain that condition of soil-mulch which prevents rapid evaporation of moisture and accelerates the action of nitrifying bacteria.

Various makes of scarifiers are obtainable, but perhaps the two most popular are the Planet Jr. and the Harvey low-down spring-tooth cultivator. The former is a good all-round implement, especially the large (No. 42) thirteen-coulter machine, which stirs the soil for a width of 7 ft. 6 in. at a passage, provided the extensions are used on the outside of the wheels. To work this implement effectively in heavy land three good horses will be required, but two can work the machine comfortably if the extension coulters are removed. It then stirs the soil for a width of 5 ft. 3 in. at a passage. On the other hand, if the extension coulters are retained and five of the centre coulters are removed the implement can be operated easily by two horses, and made to stir the soil close to the trunks without fear of injury to the branches either by chains or swingletrees. When so converted it works on the principle of the orchard disk. To reduce the danger of root-injury it is advisable to set the two coulters nearest the tree lighter than the others. This can be done by slackening off the set-nut of the clamp and lifting the coulters in the socket on the back bar of the frame, retightening the nut when the desired adjustment has been obtained. This machine is to be recommended for the person or persons who have a large area planted in fruit, but it will hardly pay the man who has only a small holding to keep three horses to operate it.

An implement that is much liked by the orchardist who can keep two horses to do his work is the Planet Jr. catalogued as No. 41. This implement is equipped with eleven coulters, and is so constructed that the team can be hitched 15 in. to the left-hand side by unscrewing four nuts, moving pole and swingletrees bodily from the centre, and placing bolts in the holes provided for such adjustment. This alteration of the point of draught will force the implement under the spreading branches, and stir the soil close to the trunks of the trees, while the off-side horse walks clear of the branches. This side hitch creates some side draught, however, which is not desirable, owing to the fact that it is rather uncomfortable for the team. To overcome this I find it is a great advantage to attach with a chain to the implement one leaf of an ordinary tine harrow, just behind the second coulters, counting from the left. When the proper point of adjustment has been attained



FIG. 5. PLANET JR. NO. 8, FITTED AS A NINE-TOOTH MACHINE, SCARIFYING CLOSE UP TO SIX-YEAR-OLD TREES.

Note handles turned to side to ensure branch clearance.



FIG. 6. SHOWING CONSTRUCTION OF PLANET JR. SCARIFIER NO. 8 FITTED AS A NINE-TOOTH MACHINE.

Stabilizing guides marked S. Points marked X show where framework to carry extra four teeth is bolted on to ordinary No. 8 five-tooth machine

the scarifier will work as evenly and as straight as if the team were pulling from the centre of the frame. (See Fig. 4.) The Planet Jr. No. 46 is an implement of later design, which has certain advantages that No. 41 does not possess. One outstanding feature is the elimination of the depth hand-levers by substituting ones that can be operated with the foot.

Smaller types of implements are necessary for the small orchardist whose holding can maintain only one horse. For this class of grower I consider the most suitable machines are the Harvey and the Planet Jr. No. 8. The Harvey spring-tooth cultivator is an ideal implement for close cultivation under spreading trees. It is fitted with a patent attachment by which the machine can be quickly changed from the ordinary machine which follows the horse to one that will work to the side under the trees while the horse walks clear of the limbs. The machine is set over under the trees by simply dropping a link in the draught-chain and setting the disk, which acts as a rudder at the rear of the machine, at the desired angle. This implement is made in sections of nine tines to the section, and is so constructed that one or more sections can be linked on if desired. One good strong horse can easily pull one section.

For the orchardist starting in a small way the No. 8 Planet Jr. is an invaluable implement, especially if intercropping is carried on until the trees come into bearing. Used as a five-tooth machine it is eminently fitted for cultivating potatoes, peas, beans, and various sorts of farm crops. For cultivating close up to small trees the cultivating width of the machine can be increased to 47 in. by adding four extra teeth. When so fitted and expanded to its maximum width it will work without the operator holding fast to the handles, provided the stabilizing-guides are attached to the two outer teeth at the rear (see Fig. 6). This is a very decided advantage over the same implement operated as a five-tooth machine, especially when cultivating close up to the rows of young trees. It leaves the operator with both hands free to guide the horse, a feature that will be readily appreciated when driving alongside young trees during their first and second seasons.

All the above-described implements do really effective work, and are to be recommended for all classes of soils. One thing I would advise the inexperienced to guard against, and that is to never let the weeds get too well established before using the scarifier. One stroke of the cultivator in time—just before the weed-roots have obtained a firm grip of the ground—will be of more value than two or perhaps three strokes of the same implement if the operation is long delayed.

HAULAGE POWER.

The horse supplies the general haulage power for all the implements just described. Specially designed motor-tractors are doing good work in many of the fruitgrowing districts in other parts of the world, but at the present time there are very few, if any, of a really suitable type to be found in our New Zealand orchards. The cost of tractors is still beyond the reach of the average orchardist. Although the cost should be reduced considerably when shipping freight-rates become normal, until such time arrives the orchardist will probably be wise to consider that the horse supplies the most reliable and economical tractive power that he can use.

WORK FOR THE COMING MONTH.

THE ORCHARD.

THE essential need of a more thorough organization of the fruit industry of the Dominion has been generally recognized and discussed by both grower and consumer alike for some time past, but although considerable progress has been made in general organization, resulting in the industry being placed on a very much more satisfactory footing than previously, the all-important factors of distribution and marketing are in quite as unsatisfactory a state as ever.

The market price of fruit this season is lower than usual—much lower than retail prices suggest—while the cost of production has considerably increased. The grower's concern in this matter has been and still is the bringing into existence an organization that will result in materially increasing the consumption, and at the same time return to him a greater proportion of the consumer's shilling than has hitherto been the case. The consumer's interest in the matter has been to see it adjusted in a way which would enable him to readily obtain fruit of a reliable quality at a more reasonable price.

Although the desires of both ends of the industry are thus largely identical, the solution of the problem is wholly a matter for the fruit-grower, and it is to be hoped that the forthcoming conference of the Federation, which opens in Wellington on 26th instant, will give this matter its earnest attention, as well as those problems connected with the export of fruit which presented themselves this season, with a view to placing both phases of the industry on a more satisfactory footing before next season.

FIRE-BLIGHT.

The work of eradicating fire-blight from the affected areas of the Auckland Province is progressing satisfactorily. In addition to all available Horticulture Division officers a large temporary staff is still engaged on inspection, cutting out of diseased wood, and the destruction of badly affected trees. This work will probably be completed by the end of the month. A concentrated effort will again be made in the early spring for the purpose of detecting and removing all hold-over cankers which may have been overlooked.

—J. A. Campbell, *Assistant Director of the Horticulture Division.*

AUCKLAND.

Growers who are anxious to get other work well in hand may proceed with stone-fruit pruning operations during June. Any draining-work that requires to be done should be attended to. Work among shelter-trees which require trimming, or temporary belts which require thinning out or lopping, may be carried out before the rush of pruning and winter spraying comes. In cases where the preparation of land for planting is yet undone, and weather conditions permit, opportunity should be taken of putting this work through. Autumn ploughing

in the orchard should now be completed. If any repairs are needed to glass-houses or sheds, these should not be overlooked whilst there is a general slackness in the more important work. Replenish stocks of spraying-materials and manures, and overhaul sprayers.

—J. W. Collard, *Orchard Instructor, Auckland.*

HAWKE'S BAY.

The present is an opportune time to review the results obtained during the season just closing, and formulate a plan of campaign under which to conduct the coming season's efforts. The effects of pruning operations will be fresh in mind, and may be pursued or modified as results have indicated necessary. The fungoid diseases and insect pests should not be overlooked, and records checked of the control measures applied. It is by a close examination of all these details that one is able to define as something concrete the results of experience.

General orchard ground operations, such as ploughing, draining, and cleaning existing drains, should be undertaken when the soil conditions are favourable. The month is a very suitable time to attend to the thinning, topping, or trimming of shelter-trees. Many poplar belts throughout the district are too thick. This state is no doubt desirable when the hedge is young and gives immediate shelter, but the stage of growth arrives when thinning becomes necessary to ensure a desirable permanent belt. This work may be carried out when soil conditions are not favourable to land work. The wet days may be profitably spent in cleaning up the packing-sheds, overhauling implements and spraying plant, &c. The pruning of fruit-trees will be the main work during the dormant season. Stone-fruits are usually in a dormant state before the pome fruits, and the pruning of such should be pushed on as rapidly as possible. Cut out all dead wood, remove all mummified fruits, and rake up all prunings and destroy.

Where the land has been properly prepared, and when the soil conditions are favourable, planting may be done. Planting operations should not be carried out when the soil is saturated. However, if the trees come to hand at that time they should be taken from the bundles and trenched in temporary quarters.

—W. H. Rice, *Orchard Instructor, Hastings.*

NELSON.

During June orchard pruning is generally commenced. It is a subject about which a great deal has been written, and every "system" has its advocates. At the present moment it is advisable to carefully consider the trees to be pruned. There is not a row of Sturmers in any orchard which does not present a variety of problems. Here, we have a vigorous tree in good condition fit to carry a maximum crop; there, is a backward tree inclined to be stunted in its growth; here again, is a good tree that has had a leader or two broken out during summer. There are dozens of types of this one variety of orchard-tree, and three or four are to be found in any orchard. The skilful pruner will consider these: The vigorous trees will be pruned with a view to getting a maximum crop; the weak trees with a view to invigorating them; the broken tree with a view to building it up again; the tree with a dense top will be pruned with a view to letting the light in, so that the lower limbs may be clothed with fruitful spurs and laterals. Under these circumstances our favourite "system" will sometimes have to be let go; a place will be found for "hard" pruning as well as "light" pruning, and even the old-fashioned lateral pruning cannot be ignored. This, to some, may look as if our carefully-thought-out principles are cast to the winds; but is it not adding to the science of pruning the art of its application?

Where grafting has to be done later, collect the scions when pruning, and heel them in a shady place.

The fruit-store will be a busy place during the month. Inspect the stocks at frequent intervals and note developments. On cold nights freely ventilate the stores, which will be easily done if the fruit is properly stacked. The idea is to let off the gases generated by the fruit and reduce the temperature.

On the market one often meets with Sturmer apples in the month of June, and Jonathan and Munroe in October and November. This generally is bad practice, and to the detriment of grower and consumer. If the storing has been fairly considered the right varieties should be easily available. By the end of June the last of the Cox Orange should be despatched; and probably in July and August we should see the last of Jonathan and Munroe respectively, leaving for the spring months Sturmer, Delicious, and the like. We are anxious that the consumer should cultivate his taste and get the right apple at the right time. How can he do this if we do not supply them in the right order?

"Prevention is better than cure" is a proverb never out of season. If an enemy were to allow diseased fruit to drop into your orchard, what indignation it would arouse! Do not be your own enemy; do not allow waste fruit to accumulate about your store. Feed it to the pigs before it is waste.

Where planting is to be done inspect the trees carefully on arrival. If moist and well packed they may keep all right for a few days in the package, in a moist shady position. As a rule it is best to unpack them and carefully feel them in in the open ground. Plant them out when the land is prepared and the soil in good friable condition. Plant them firmly.

—W. C. Hyde, Orchard Instructor, Nelson.

MOTUEKA.

The main work now to be put in hand is the winter pruning of fruit-trees. Practical instruction on the spot will be given as far as possible, but a few general hints may be given for the guidance of pruners. Firstly, use a good pair of secateurs and keep a fine edge on the blade. Aim to keep the proportional symmetry of the trees so that ventilation and sunlight may be evenly admitted. Remove any diseased wood, paying particular attention to powdery-mildew infection. Destroy by burning all diseased portions removed. For the future well-being of the trees it is better to cut too hard than too light, although both extremes should be avoided. Peach and nectarine trees require a much harder system of pruning than generally practised in this district; plenty of new wood must be induced each year for the following season's fruit. Mark out proved unprofitable varieties for removal; every season they are left may be counted as a season lost; they should be replaced as early as possible by reworking or the planting of better varieties.

Winter cultivation should be put in hand as soon as possible. Ploughing on to the trees and leaving the furrows turned up to the action of the winter frosts is beneficial; this also provides an open furrow in the centre of the rows of trees to take away surplus water.

General draining-work should be attended to, new drains being made where required, and established drains kept in proper working-condition.

Preparations should be made for the eradication and control of insect pests by the application of a heavy dressing of red-oil emulsion, 1-8, during the dormant season. Where the infection is very bad two dressings may be applied, one to be made immediately and another just before the buds burst.

W. T. Goodwin, Orchard Instructor, Motueka.

CANTERBURY.

After a thorough clean-up of the orchard in the way of stacking away fruit-cases, clearing out drains, cutting and trimming shelter-belts and hedges, the main work of the orchardist at this season of the year will be pruning.

Stone-fruit pruning should be well advanced by this time, and completed before a start is made with apples and pears. As the pruning season is a fairly long one it is advisable for growers to spray their trees and not cut in any haphazard way. Growth made during the season—fruiting wood, spurs, and laterals—should all be considered and cut accordingly. Consideration should also be given to the local conditions prevailing as well as to the generally accepted principles of pruning. It is hardly necessary in this district to warn growers against excessive pruning, as in many cases insufficient wood is taken out. As the majority of apple-trees spur very freely in this district attention should be given to the thinning-out of these spurs, especially in full-bearing trees. Better-quality fruit will be the result.

In regard to cool-stored fruit, growers have a splendid market right at home, and it is for them to market their fruit advantageously. When taking fruit from the cool stores go through it systematically and conscientiously, and only place first-class fruit on the market.

Although spraying for the majority of insect pests can be delayed for a time, it is as well for growers to give their stone-fruit trees an application of 8-6-40 bordeaux, especially where leaf-curl, die-back, and rust have been prevalent. In some cases, where woolly aphid and red mite have been bad, it would be as well to make two sprayings of red oil during the dormant season. If so, an application at strength 1-8 towards the end of the month will do much good. On the whole, orchardists in this district are to be congratulated on the clean state of their orchards. I am sure that this is directly due to the extra spraying

done last winter and the thoroughness with which it was carried out. A little additional this season will mean even cleaner orchards next year. Do it.

—*G. Stratford, Orchard Instructor, Christchurch.*

OTAGO.

Advices to hand (at end of April) indicate the need for care in the storage of late varieties of apples, as black-spot has begun to develop in consequence of autumn rains. To prevent this disease spreading in the cases it is necessary to have plenty of ventilation, during the first few weeks particularly. Pick fruit dry into seasoned cases, and stack in such a way that the air will pass through them freely. All affected apples should be kept apart from the clean fruit.

Pruning will be the next important operation in the orchard, and the best men to undertake this work are those who have carried out the picking during the season, provided they are competent. The men who are constantly in the orchard and at all observant will have noticed the peculiarities of the different varieties. Some will have been overloaded, due perhaps to insufficient pruning last winter, while others will have gone to rank growth, perhaps due to too severe pruning previously. Then, again, the method of fruit-bearing must be studied. Most varieties will bear some fruit on laterals as well as spur freely, but all will not bear heavy crops if treated solely for spur bearing. Some varieties of apples and pears also will spur freely as the trees decrease in vigour, but while they are growing rankly laterals must often be left in to start them bearing. The same applies to stone-fruits, and these must be studied closely if the best results are to be obtained.

Growers will all have heard of the outbreak of American fire-blight in the North Island, and it behoves all to keep a sharp lookout for any sign of this disease. Should any grower find any suspicious signs I shall be glad if he will draw my attention to it at once in order to enable precautions to be taken.

—*J. H. Thorp, Orchard Instructor, Dunedin.*

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

MANAGEMENT OF THE BREEDING-STOCK.

WHERE it is intended to commence hatching in July (which is a good time for bringing out the chicks of the heavier breeds) preparations for this important operation should be got under way at once. The breeding-pens should be mated up with as little delay as possible, in order that the birds may be well settled down before their eggs are required for hatching purposes. They should also be put on a special diet. The proper feeding of the parents is all-important if success is to be assured in the hatching and rearing of their progeny. The ration should be plain, and on no account should the birds be forced for heavy laying.

In this respect it is not as well understood among poultrymen as it should be that many of the troubles met with in the hatching and rearing of chickens are due to improper feeding of the parent birds. The most common error made is to feed to excess rich foods, such as meat, milk, &c., with a view to securing a high egg-yield. In breeding operations it is not a record number of eggs that should be looked for, but rather the greatest number of fertile eggs and the production of a high percentage of healthy vigorous chicks.

It is often said, and rightly so, that if given a good sturdy chick half the trouble of rearing it is over. To bear out this contention one

has only to study the behaviour of chicks bred from forced parents and those that are not. The former appear to have few, if any, natural instincts, except perhaps to make a continual distressed chirp as indicating that all is not well with them. They are usually slow to commence eating and to take exercise, while their general appearance denotes a delicate condition. As a rule, heavy mortality takes place from the fifth to the eighth day. The food, the brooder, and many so-called mysterious diseases are usually blamed for the disaster, whereas in many cases mismanagement of the breeding-stock is alone responsible. In such cases it will usually be found on making a *post mortem* examination that the liver presents an unhealthy yellow appearance, showing that the little one had been hatched out in an unhealthy condition. On the other hand, the chicks produced from parents fed and managed in a proper manner will give evidence of possessing strong constitutional vigour immediately they leave the incubator. They soon learn to eat, to take exercise, and to know where they can get a warm-up when required. In short, their behaviour denotes a healthy, contented condition.

Of course, it is not to be inferred that because a chick is hatched out in a healthy robust state it will necessarily thrive, or even live, irrespective of the attention it receives during the brooder stage. Success in rearing brooder chicks depends on numerous details being observed, and if these are departed from failure is inevitable. It is, however, safe to say that correct management of the breeding-stock lies at the base of this important work.

It is now generally recognized that it is an unwise policy to feed wet mash to breeding-stock. The best plan is to provide at all times a mixture of dry grains, such as wheat, oats, and maize. This should be fed in deep scratching-material, which is an excellent means of inducing exercise—an essential for the maintenance of a healthy flock. This, of course, applies only where birds are kept in confined quarters, for where free range is available nothing can take its place in providing healthy exercise and ideal conditions for breeding-birds. Where a whole-grain ration is provided it is of the first importance that hard grit be always available to the birds for the purpose of aiding digestion. Green food is another essential that should be daily and liberally provided.

Do not on any account allow the breeding-hens to become too fat, as a strong chick cannot be produced from an overfat mother. A good plan is to periodically handle the birds when on their perch in order to ascertain their condition. Too much maize is apt to have an over-fattening effect; therefore if the birds give evidence of becoming too fat the exercise should be increased and the amount of maize reduced.

In mating birds never use a male unless he is in perfect health and condition. It is always a mistake trying to doctor up for the breeding-pen a bird that has apparently recovered from some disorder. To ensure the most satisfactory results there must be no question as to the constitutional vigour of the parents.

Another important matter that should be now attended to is overhauling the incubators and brooder appliances. Everything should be done to rectify anticipated trouble, such as providing fresh burners for lamps where worn out, new connecting-rods for the incubators where

the old ones have become bent, or new thermometers for those which have been broken. It is also a good plan always to have a good stock of lamp-wicks of the correct sizes to fit the lamp-burners. It must be remembered that duplicate parts of appliances are often difficult to secure in these times, so that failure to attend to these little details now may cause endless worry and loss of time at a later date.

NEW BREEDS.

Notwithstanding the present acute shortage of fowl-feed, and the scarcity of the fresh-egg product, it is to be regretted that there is a great tendency on the part of many poultry-keepers to take up any new, untried breed (from a utility viewpoint) which has merely special feathering, &c., as its principal recommendation. It is a much safer policy to adhere to the well-known breeds which have been so well improved as utility stock, especially as some of the new types have yet to be developed for standard requirements before even the work of selection to secure a utility standard is attempted. The endeavour to advance breed character and utility qualities at one and the same time is an almost impossible task. It is most important at the present time—from the individual as well as the national point of view—that we should do all in our power to preserve at a high standard the breeds we have developed to suit our special requirements.

THE APIARY.

G. V. WESTBROOKE, Apiary Instructor.

OFF-SEASON WORK.

AT this season of the year the bees should be all prepared for their winter rest. There should be no manipulation of the hives beyond lifting the covers occasionally to see that the mats are dry. Nothing is more detrimental to the bees than to have damp mats—in fact, it would be better to have no mats at all than allow them to remain wet. If the covers are sound there will be no risk of any such conditions. It is, however, always a good policy to have a few spare covers in good repair; then when leaky ones are discovered they can be replaced by the sound ones. Those removed can be repaired when convenient, and be in readiness for future use. One of the best methods of repairing faulty covers is to first give them a coat of paint, then spread tightly over it cheesecloth or similar material, and finally apply another coat of paint over all.

All supers that are free from bees should be removed to the store-room. They can then be given a fresh coat of paint in readiness for next season's crop. Where no fumigator comb-room is available empty combs should be left in supers and tiered up, placing them on a solid foundation, with a queen-excluder at the top and bottom of each tier to exclude mice. A few carbon balls in each pile will assist in keeping away the wax-moth.

The comparatively quiet months of the winter should also be utilized for overhauling all material not in use. The extractor should be carefully cleaned, and given a light coating of vaseline to prevent rusting. Any odd scraps of wax or broken comb should be melted down, and all work that it is possible to do in the way of preparation for next season should be undertaken.

THE ANNUAL CONFERENCE.

Beekeepers may be reminded that the annual conference of the New Zealand Beekeepers' Association will be held at Christchurch on 9th, 10th, and 11th June. All persons interested in beekeeping are welcome to attend.

VITICULTURE.

S. F. ANDERSON, Vine and Wine Instructor.

NATURAL AND ARTIFICIALLY SWEETENED WINES.

A NATURAL wine is one made from ripe grapes containing generally not less than 20 per cent. of natural sugar. They may in favourable years contain a higher percentage than this, but have never been known to contain a higher percentage of grape-sugar than can be transformed into alcohol by fermentation, resulting in the wine being dry. The alcoholic strengths of these wines have ranged from 10 to 14.5 per cent. by volume, corresponding to 21.9 and 26.0 per cent. of proof spirit. Wine so made is a natural wine, because no addition whatever is made to the natural product of the grape. It contains all the fruitiness of the grape with sufficient alcohol to keep it, and improves by age up to ten years. It is at its best between four and ten years. Although, compared with other alcoholic beverages, the strength may appear high, the other ingredients of the wine, such as the tartaric, citric, and tannic acids, and other matters only found in combination in wine, go to make a natural wine the healthiest and least intoxicating.

A wine to be sweet and yet to keep must have a much higher percentage of alcohol than a natural dry wine. The sweet wines made from New Zealand grapes therefore require fortifying up to 28.9 per cent. of proof spirit. At less than this they are liable to change with variation of the temperature in which they are kept. Australian, African, and other imported sweet wines go as high as 34 per cent. of proof spirit. Pure spirit is the only lawful means of preserving sweet wine. To add any antiseptic is forbidden by the regulations of our Pure Food and Drugs Act. There are several methods of making sweet wines. In New Zealand it is customary to add sugar and alcohol to the ordinary dry wine. This is too often done in a haphazard manner by the vigneron, the result sometimes being a wine not keeping well, or being too fiery or too sweet.

The following method may be taken as a proper basis to go on: It is assumed the wine to be sweetened and fortified has been made

from grapes that showed by Guyot's saccharometer 20 per cent. of natural sugar—that is, in every 100 lb. (or 10 gallons) of the must there is 20 lb. of sugar. After fermentation the resulting wine will contain 11.76 ($20 \div 1.7$) of absolute alcohol by volume, equivalent to 20.6 of proof spirit. But this is a dry wine, and it is required to be sweet. An ordinary sweet wine contains from 6 to 8 per cent. of sugar, and here we will calculate on sweetening it to 8 per cent. This is equal to 8 lb. of sugar to every 100 lb. (or 10 gallons) of the wine. This sugar should be dissolved in a portion of the wine in a copper boiler by heating it till it steams—that is, about 140° F. It must not boil, as that would impart a cooked flavour and possibly make the wine more difficult to clear. When quite cool it is then put into the wine and the whole thoroughly stirred.

The wine is now sweetened, but for keeping it requires additional alcohol. As already indicated, to keep a sweet wine from changing its condition it must have at least 16.30 of absolute alcohol by volume, or 28.9 of proof spirit, in it. The additional alcohol required as proof spirit may be calculated as follows: $28.9 - 20.6 = 8.3 \times 100 = 830$. $100 - 20.6 = 79.4$. $830 \div 79.4 = 10.45$ (say, $10\frac{1}{2}$ gallons). Should the wine contain over 20.6 per cent. of proof spirit, or the spirit used be over or under proof, the computation must, of course, be made accordingly.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

EARLY cauliflowers and cabbages are an important crop and deserving of a little extra attention. In the northern districts plants should be ready for setting out early in June—that is, plants from the sowings made at the end of March. It has been said before that it pays to prick the plants out as soon as they can be handled, but there are few who do so. Where this has not been done care should be taken that the plants do not become drawn by being crowded in the beds. They are very liable to become weakened in this way during the period of short days we are now in. Weeds should be rigorously suppressed, as they create a dampness about the stems and a general weakness of the plants. A little air-slaked quicklime dusted among the plants occasionally helps to keep them sound. If insect pests are present spray with Vistolene. The spray is best applied by means of a pneumatic sprayer. These machines deposit the spray in a fine mist and use very little material, which is an advantage at this season.

Peas may now be sown in early districts, but only dwarf varieties. In some parts slugs and snails are very troublesome by the time the plants from this sowing should be growing well. In large cultivations this trouble is not much felt, but in domestic gardens where a few rows are in close proximity to other crops that afford good shelter for slugs the trouble is sometimes very considerable, the long nights being in

favour of the pests. In such cases the trouble can be overcome by supplying sticks for the support of the pea-haulm—slugs and snails are troublesome only when the haulm lies on the ground. Birds are another trouble in many places, but they never touch peas after sticks have been put in. In any case it is worth while to give sticks where it can be managed, for even dwarf peas are greatly improved thereby.

Broad beans should be planted by the middle of June. This is a matter of ordinary routine, and provides the early crop. In all mild places lettuces may be planted all the year round, during the winter months selecting the warmest position for them and usually planting on raised beds. Endive, being hardier than the lettuce, often gives better results.

Winter rhubarb may still be planted. Though, of course, the produce cannot be great this coming winter, it is worth while to plant, as stalks can be taken as soon as they grow, in which respect the plant differs materially from the summer variety. Except in places where the winters are severe, it is not now necessary to force rhubarb for winter use. The winter variety is now coming freely into the market, and will no doubt reach the southern towns.

Seakale may be forced at any time from now till the plants start growing in spring. Books on English gardening describe methods for lifting the crowns and forcing them under glass in specially constructed houses. These methods are now applicable in this country. The clumps should be forced where they are growing in the open ground. All that is required is to clear off the old leaves, give a sprinkling of lime and soot to kill slugs and keep wireworms out, and then cover the clumps with a benzine-case with the bottom (which will then be the top) loosened so that it can be lifted. Cover about 1 ft. deep with fermenting stable dung. The heads will be ready in about fourteen days. The bed should be forced in batches. This is a crop no good garden should be without; it makes a particularly attractive and delicate dish. The plants will grow in any odd corner of the garden and are very little trouble. The manure after the crop is taken is available for use on another part of the garden.

Asparagus-tops should be cut down before the ripe berries fall. Cut close to the ground so as not to leave snags of the old stems. At this time no other attention is required except to lightly loosen the surface soil. A tine hoe, often termed a "drag," will usually be the best tool to use.

Vacant ground should not be allowed to grow weeds. These rob the soil, and form a harbour for vermin, which give endless trouble in spring when seeds are sown. Turn the soil over and give it the benefit of sun and air.

SMALL FRUITS.

Loganberries.—The cultivation of this fruit is so rapidly extending that it will apparently in the near future become the most extensively grown of all the small fruits. The fruit is best described as being a vastly improved blackberry, but with much greater productivity. It does not appear to be subject to any pest, either fungoid or insect;

its growth is easily controlled; and as it does not form suckers and rarely seeds it is not possible for it to spread and become a noxious weed. The plant is not particular as to soil, though best results are naturally obtained on fairly good, moisture-holding land. Propagation is by layers from the young rods, and by cuttings. The cuttings are made from young rods taken in winter and cut into about 12 in. lengths. These should be planted firmly, all but the two top buds being buried in the soil. Propagation by cuttings should be in nursery beds, not *in situ*. The habit of the plant is to make very long runners or rods, which bear fruit the season after they are made. Fruit is borne on sprays that emerge from buds formed in the axils of the leaves, every matured bud being capable of producing a spray of fruit. The ends of the rods, being late growth, do not mature the buds; therefore a length is cut off when the rods are tied in place. In open-field culture the rods are only allowed to bear fruit one season, being cut out when fruiting is over, and new rods, which are made each season, tied in to take their place. For training by the trellis system the plants are set 8 ft. apart each way, and each row should have a post-and-wire trellis, the posts being set at every fourth plant. Posts should be 7 ft. long, 2 ft. being in the ground. Three wires of No. 12 gauge are fixed, one on top, the others one-third and two-thirds from the ground. An improved trellis has two sets of wires, one on each side of the posts. In this case the bearing-rods are tied to one set and the young rods as they grow are trained to the opposite set. The gain is ease in handling, and the young rods do not crowd and shade the bearing-rods. It is noticed that in some gardens the rods are tied to stakes in the way raspberries are supported. This plan is bad; bearing cannot be satisfactory unless the rods are trained to a horizontal position, or nearly so.

Raspberries.—A fairly good and moisture-holding soil is necessary for raspberries; it is useless to plant on dry soil. Several different plans of planting are in vogue, but that most frequently adopted is the hill method. Clumps of three are set 5 ft. apart from centre to centre. The three sets in a hill are planted in a triangle, each plant about 9 in. apart. Young suckers taken at a distance from the stool are best for planting. These suckers will not have much top, but will have a good bunch of roots. After planting cut the tops down to within 6 in. of the ground as a maximum to leave. A good crop should be obtained the second year. Established plantations should now be put in order. Surplus suckers should be forked out; cutting them off leads to multiplication and future trouble. The canes that have borne fruit are now dead and should be cut out. Cut as close as possible to the stool, so as not to leave a stump of dead wood. If the canes are infested with scale insects they should be sprayed with lime-sulphur, 1-15, which will also act as a fungicide. The best varieties are Antwerp, All Summer, Northumberland Fillbasket, Superlative, Semper Fidelis, and Fastolf.

Gooseberries.—Any moderately good soil will grow this fruit, though they do best on what is considered good vegetable-garden soil. The gooseberry does not succeed in the warmest parts of the Dominion. Bushes are raised from cuttings, which should be about 15 in. long. All buds except four or five at the top should be cut clean out, so as to prevent suckering. Bushes should be trained to a single trunk

with at least 8 in. without branches. Four main branches are sufficient; more than that number is too many. The first winter after planting these four branches should be headed down to 10 in. or 12 in. From each shortened branch two new leaders should be allowed, these being in their turn shortened back as before, and so on in after-years till the bushes have attained full height—about 4 ft. When pruning established bushes the aim should be to keep the centre open, so that the sun can reach all parts of the bush, and to keep the growths far enough apart to enable easy gathering of the fruit. This condition allows a free passage for light and air, promotes strong, fruitful growth, and enables a bush to bear good fruit on all its parts. Crowded bushes are wasteful; they bear good fruit only on the outside, and give a lot of trouble in gathering. The young shoots require different treatment according to their position and strength. Occasionally very strong shoots appear on the lower part of a bush. These should be cut clean out, taking care to cut hard into the old wood so as to leave no basal buds, which would each develop into another strong shoot and make the condition worse than before. Strong and moderately strong shoots should merely be tipped so as to take off the latest growth, which is not mature. Weak shoots may be cut harder in proportion, and very weak shoots, as well as all on the lower parts of the bush, should be cut back to spurs about $\frac{3}{4}$ in. long. This is done because the lower part of the bush is the weakest, and restricting the number of berries enables the bush to bring them to the same perfection as a greater number on the higher parts. There are a large number of very fine varieties, and it is not an easy matter to distinguish a few. The favourite with market-gardeners has for some years been Farmers' Glory, a very prolific variety that makes a good bush. The fruit is large and long in shape, and red when ripe. Other good varieties are: Green—Green Overall, Gregory's Perfection, Marigold, Jolly Tar, Alarm; red—Billy Dean, Champagne, Crown Bob, Ironmonger, Ploughboy, Red Rough, and Warrington (for preserving), Roaring Lion, Whinham's Industry, St. Clair; white—Alma, Whitesmith, Lady Leicester, Careless, Postman, Bright Venus; yellow—Broom Girl, High Sheriff, Pineapple, Drill, Gunner, Smiling Beauty.

Red Currants.—Fruit is borne only on spurs on wood that is two and more years old, never on young shoots. The aim, therefore, is to produce branches that will carry spurs. It is important that the bushes be trained so that light can reach every part, for every part from the base of the branches to the top is capable of bearing fruit, but will not do so if crowded. Cuttings should be prepared as described for gooseberries, but only three main branches should be allowed for a start. Heading-down is the same as for gooseberries. At the annual pruning all shoots that are not leaders are to be reduced to spurs about $\frac{3}{4}$ in. long, but there is some preliminary shortening done during summer, which will be described at the proper time. Success cannot be secured unless the right varieties are planted. There are varieties that do well in other countries but will not bear fruit in this country. Among them are Raby Castle and American Wonder. Varieties that succeed are La Versailles, Fay's Prolific, Chenanceau, Bertyn's No. 9, Cherry.

Black Currants.—A cool climate and deep strong soil suit this plant; it is quite useless to plant them in dry soil. In every part of New Zealand borers give a good deal of trouble, and it is impossible to profitably grow the fruit unless conditions are such as will ensure a strong growth of plant. Frequent renewal of branches makes it possible to overcome the borer. The cuttings should be allowed to retain all the buds; this establishes a stooling habit—that is, shoots are pushed up from below the surface of the soil, and these take the place of old branches that are becoming infested with borers. Fruit is borne on wood of the previous season's growth as well as on spurs on older wood. On this account pruning is quite different from that for the red currant, more nearly approximating to that for the gooseberry as now practised. In former times both the gooseberry and the black currant were spur-pruned, and it was adherence to that practice that caused many growers in this country to abandon the culture of black currants. I am aware of only two varieties that have proved uniformly good—Carter's Black Champion and Kentish Hero. Currants and gooseberries should be planted 5 ft. apart each way.

Strawberries.—In many places autumn planting is practised, and this is already done. Spring planting is yet of the future. Where new land is to be planted the ground should be in course of preparation. Where the land is in grass-sod there is choice of two courses of procedure. One is to plough shallow and allow the turf to decay, then plough deep in spring so as to bury the disintegrated turf. The other is to plough deep now and shallow in spring. The former plan has the advantage of securing a greater degree of disintegration of the turf, which is a great advantage. The latter plan is best if the soil holds water near the surface. Old plants that are to be kept should have the foliage cut off, which should be removed and burned, or if it will dry sufficiently it may be burned where it lies, this being often done where there is leaf-spot infection. Some straw or dry pine-needles will help the burn. After cutting the foliage the plants should be sprayed with 4-4-40 bordeaux mixture.

Cape Gooseberries.—The seed may be sown in boxes under glass. When large enough to handle, prick off into other boxes, and keep the plants in shelter till spring frosts are past.

Garton Oats at Weraroa.—A crop of Garton oats at the Central Development Farm threshed out 84 bushels per acre last month. Algerian oats, also Black Tartars, lodged very badly during the season and suffered much during harvest, but the Gartons, although a heavier crop, remained standing throughout.

Local Demonstration Farms.—The committee of the Stratford Model Dairy Farm recently paid a visit to the Waimate West Demonstration Area, near Manaia, and were met by the local committee. After an inspection of the area—crops, top-dressed paddocks, milking-shed, &c.—some time was spent in exchanging views on farm matters concerning both districts. Such visits should be of distinct mutual benefit.



A RECENT STREET-WINDOW DISPLAY OF NEW ZEALAND WOOL AND WOOLLENS AT THE OFFICE OF THE HIGH COMMISSIONER, LONDON.
Model of shearing-shed in centre made by New Zealand soldiers.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

COW WITH SEROUS ABSCESS ON KNEE.

"SUBSCRIBER," Howick :—

I have a cow suffering from an enlargement of the knee, the size of a man's closed hand. It feels quite soft to touch as if full of water or air. The swelling does not seem to affect the animal's general health, but causes a little stiffness when it moves quickly. The cow may have fallen on the concrete floor of a milking-shed. Can you tell me of a cure for this trouble?

The Live-stock Division :—

The swelling described is fairly common among cattle. The enlargement is due to a collection of straw-coloured fluid underneath the skin of the knee, and is known as a serous abscess. It is due to an injury, and may have been caused, as you suggest, by the animal falling on the concrete, or lying on hard uneven surfaces. In the latter case the injury is received when the animal is getting up, as at that time the whole weight of the body is thrown on the knees. The swelling is best treated by opening the abscess and allowing the fluid to escape, after which the opening should be plugged with a piece of antiseptic tow on which has been smeared a quantity of biniodide of mercury. This dressing should be allowed to remain for a day or two in the opening, when it should be removed and the opening allowed to heal. The opening should be made on one or other side, so that the animal will not injure the wound when getting up and down.

RENOVATING A PASPALUM-PADDOCK.

J. O'SULLIVAN, Manawaru :—

Kindly advise regarding the best means of renovating an old paspalum-paddock without ploughing it up. The ground is fairly light.

The Fields Instruction Branch :—

Previous to carrying out this work the pasture should be fed down as hard as possible. Then load a disk harrow with sacks of earth and give the land a good cutting-up. When this has been done the tine harrows may be employed. Give an additional seeding of $\frac{1}{4}$ lb. paspalum and 2 lb. white clover to the acre, and roll down with the Cambridge roller. Then close the paddock up for a time to recover.

MARROWS AND PUMPKINS FOR STORING.

"SUBSCRIBER," Pihama :—

Could you tell me how vegetable marrows and pumpkins may be kept through the winter? Last year I had a good crop, which I pulled in May and put away in a dry shed. In about six weeks most of them went rotten.

The Horticulture Division :—

The keeping of marrows and pumpkins depends on their having reached a certain degree of ripeness. If allowed to ripen to the full extent they will keep several years, but in that condition the thickness of flesh has diminished more than is desirable. If gathered when the rind is sufficiently hardened to make it difficult to pierce it with a thumb-nail they will keep nearly through winter. A little beyond that state of ripeness is safer for long keeping. It is a common practice to store late-grown fruits, but these rarely keep, as they have not had sufficient sun-heat to ripen them. Briefly, fruits for keeping should be saved from the main crop—not the tail end—and they should not be knocked about and bruised in handling.

GRANULAR VAGINITIS OF COWS.

L. C., New Plymouth :—

Kindly tell me the cause of cows constantly returning to the bull, and whether such disease has anything to do with these animals showing swelling and irritation at the rear after several periods of service. Can you recommend a remedy for this condition ?

The Live-stock Division :—

The trouble you describe is probably the result of granular vaginitis. Treatment consists in the daily washing out of the vagina with one of the following solutions—Lysol 1-80, Jeyes Fluid 1-60, Lawes Fluid 1-60, Izal 1-60—until all signs of inflammation have disappeared. The bull's sheath should also be washed out with one or other of the antiseptics mentioned. Under no circumstances whatsoever should the bull serving affected cows be allowed to serve other members of the same herd.

ERADICATING FERN ON ARABLE LAND.

A. H. HUNT, Dairy Flat :—

What is the best method of eradicating fern which has taken possession of a 6-acre field previously cultivated and cropped ? The soil is 4 ft. deep and of a loamy nature.

The Fields Instruction Branch :—

The plan generally adopted is to put the land into swedes, and to allow the crop to be eaten off by heavy cattle. The land should then be ploughed and sown with the following grass-mixture : Cocksfoot 15 lb., Italian rye-grass 7 lb., and cow-grass 5 lb. to the acre. Should the fern persist in growing after the first season the mower should be run over it now and again, and the land stocked with cattle in sufficient numbers to crush the fern out during the autumn months. For this purpose roots and hay could be carted on to the land, if necessary, so that the work be thoroughly completed.

WARTS ON COWS' TEATS.

" DAIRYMAN," Motupipi :—

One of my cows is greatly troubled with warts on her teats, and the condition seems to be spreading to the other animals of the herd. What is the quickest and most reliable cure ?

The Live-stock Division :—

A means which has been found to answer readily is to apply for several days with a sponge a strong solution of washing-soda. Another method which sometimes gives good results is to smear the teats at each milking with good olive-oil. Failing these means, the warts should be clipped off with a pair of sharp scissors, and a little caustic applied to stop any hæmorrhage.

HORSE-BEANS FOR BEE-FODDER.

S. C. SMITH, Patea :—

I should be glad of information as to the best variety and the growing of horse-beans for honey-production. In this district bees must be fed during November at least $\frac{1}{2}$ ton of sugar per 100 colonies, notwithstanding the extent of the winter stores one leaves for them. Any plant yielding nectar in late October and November would be valuable here, and I would be pleased to have advice regarding the matter.

The Horticulture Division :—

For flowering during October and November the beans should be sown in June. Drill in rows 20 in. to 24 in. apart, at the rate of about 3 bushels per acre. Variety, the common horse-bean. Flowering at a time when flowers are scarce the plants should be valuable for bees, and the crop should prove profitable apart from the bee-fodder it supplies. It would be necessary, however, to plant several acres, or the quantity of bee-fodder would be negligible.

VARIETIES OF OATS FOR HORSE-FEEDING.

T. G., Hauraki :—

Would you kindly advise me as to which is the best species of oat, the coarse (as Sparrowbill), or the fine (as Dun), to feed to horses, with particular reference to horses in training?

The Live-stock Division :—

When fed whole, Dun oats are usually preferred to Sparrowbills on account of the finer shell of the former making them easier to masticate and digest. We are of opinion that there is little, if any, difference in the relative feeding-value when both are used in a crushed condition.

HARVESTING FIELD-PEAS.

"SUBSCRIBER," Tiakitahuna :—

This year I have grown some peas and vetches, and although using a pea-harvester attached to the mowing-machine I have experienced a difficulty in harvesting the crops. The peas I could cut only one way, and in the case of the vetches the machine got choked, very often after going only a few yards. I would be pleased if you could give me any information which would enable me to overcome these difficulties.

The Fields Instruction Branch :—

Where the mowing-machine fails to do good work an ordinary one-horse hay-rake will be found a most useful implement for harvesting field-peas. The crop usually lies in one direction, and by walking the horse on the edge of the crop about half the rake will drag the crop out satisfactorily. On the return journey the other half of the rake will act in a similar manner. This method, of course, necessitates another hand to move the dumps out of the way, which may be a disadvantage; but the plan has been proved to be one of the most satisfactory. The same method should apply to vetches when sown alone, but if sown with 1 to 1½ bushels of oats the latter will usually hold the crop up sufficiently to allow the mowing-machine to be used.

FORMALIN TREATMENT FOR SEED-POTATOES.

W. V. G., Te Puke :—

Is the practice of dipping seed-potatoes in a solution of formalin and water to be recommended? If so, what quantities are used? Would this treatment be injurious to the crop?

The Horticulture Division :—

Formalin treatment is recommended for seed-tubers affected by scab (*Oospora scabies*). It has no effect on other potato-diseases. The tubers should be left two hours in a solution composed of 1 pint of formalin to 30 gallons of water. The treatment is not injurious to the crop.

CROSSING BREEDS OF FOWLS.

"INQUIRER," Picton :—

I have Leghorn and Black Minorca fowls, and wish to cross them with a heavier breed. What breed do you recommend me to try?

The Chief Poultry Instructor :—

I would recommend you to mate a White Leghorn male with Black Orpington or White Plymouth Rock females. A Minorca male mated with Black Orpington hens may also produce good dual-purpose birds. Your object in crossing is not stated, but from an egg-laying view it is preferable to keep breeds in a state of purity, especially when it is intended to breed from the progeny likely to be produced.

FEEDING OF BREEDING-SOWS.

A. FLETCHER, Te Pahu :—

We are running a number of breeding-sows in 10-acre fern-paddocks, and having just weaned their litters they are a bit low in condition. They will not touch soft turnips, and the mangolds are not quite fit to pit. Would it do any harm to thin out mangolds and feed them tops and roots together, as the pigs seem to relish them?

The Live-stock Division :—

It will not do the sows any harm to feed mangolds provided they are pulled and allowed to dry for at least one week (the longer the better), as they are liable to cause scour. Seeing that the sows are low in condition after weaning it is advisable to get them back into fair condition as quickly as possible if you wish to get the best results next farrowing. It would be advisable to purchase some pig-meal, and feed it in conjunction with the mangolds. No difficulty will be found in getting the sows to eat turnips if fed with meal.

OPOSSUMS AND ORCHARDS.

G. R. JONES, Okoia :—

Can you inform me of any way of ridding my orchard of opossums? Most of the fruitgrowers in this district are finding it impossible to get any fruit on account of these pests. They are not to be found in the daytime, but come out at night and strip the trees, breaking many of the branches.

The Horticulture Division :—

There appears to be no practicable method of getting rid of opossums but to trap or shoot them in their haunts. Before doing this it would be necessary to ascertain if the animals are protected in your district. Opossums appear to cause very little trouble to fruitgrowers in their native country. They doubtless do some damage in isolated cases, but an extensive search in Australian fruit-growing publications failed to discover any reference to them.

FORTHCOMING WINTER SHOWS.

Otago A. and P. Society: Dunedin, 1st to 4th June.

Waikato Winter Show Association: Hamilton, 1st to 5th June.

Manawatu and West Coast A. and P. Association: Palmerston North, 22nd to 25th June.

(A. and P. Association secretaries are invited to supply dates and location of their shows.)

Meal-freezing Works in New Zealand.—Dissecting the list printed on page 336 into the two main divisions of the Dominion the following results are obtained:—Beef-killing capacity per day—North Island, 3,465 (86·19 per cent. of total); South Island, 555 (13·81 per cent.). Sheep-killing capacity per day—North Island, 81,600 (61·75 per cent.); South Island, 50,550 (38·25 per cent.). Cold-storage capacity in 60 lb. mutton carcasses—North Island, 5,089,656 (65·94 per cent.); South Island, 2,628,711 (34·06 per cent.).

Introduction of Bones from Fiji.—The regulations under the Stock Act for the prevention of the introduction into New Zealand of diseases affecting stock, including provisions prohibiting the importation of animal manures except from certain countries and under certain conditions, have been amended to permit of the introduction of bones from Fiji. The new regulations, setting forth the conditions under which such importations may be made, were gazetted on 15th April, and came into force on the same date.

MAXIMUM PRICES OF FLOUR, BRAN, AND POLLARD.

AN Order in Council dated 12th April, 1920, fixes the maximum prices in New Zealand of flour, bran, and pollard respectively, previous Orders on the same subject being simultaneously revoked. The schedules dealing with the products in question are as follows :—

II. FLOUR.

1. When the nearest port is Lyttelton, Timaru, or Oamaru, the maximum price of flour as sold by the manufacturer for delivery free on board at the nearest port, in 200 lb. sacks, on the terms of payment within seven days after delivery, shall be £16 10s. per ton, less $2\frac{1}{2}$ per cent. ; and in the case of sale by the manufacturer otherwise than in manner aforesaid the maximum price shall be a price equivalent, as regards the seller, to the maximum price above mentioned.

2. In this schedule the term "nearest port" means the port of entry under the Customs Act, 1913, which is nearest to or includes the place of manufacture of the flour sold.

3. When the nearest port is a port other than Lyttelton, Timaru, or Oamaru, the maximum price of flour as sold by the manufacturer for delivery free on board at the nearest port, in 200 lb. sacks, on the terms of payment within seven days after delivery, shall be £16 10s. per ton, less $2\frac{1}{2}$ per cent. ; with such addition only as is equal to the cost of the carriage by sea of a ton of flour from Lyttelton, Timaru, or Oamaru (whichever cost is the least) to the said nearest port ; and in the case of sale by the manufacturer otherwise than in the manner aforesaid the maximum price shall be the price equivalent, as regards the seller, to the maximum price last above mentioned.

III. BRAN AND POLLARD.

1. When the nearest port is Lyttelton, Timaru, or Oamaru, the maximum price of bran and pollard as sold by the manufacturer for delivery free on board at the nearest port, on the terms of payment within seven days after delivery, shall be £7 per ton in the case of bran and £9 per ton in the case of pollard, less in each case $2\frac{1}{2}$ per cent. ; and in the case of sale by the manufacturer otherwise than in the manner aforesaid the maximum price shall be a price equivalent, as regards the seller, to the maximum prices above mentioned.

2. In this schedule the term "nearest port" means the port of entry under the Customs Act, 1913, which is nearest to or includes the place of manufacture of the bran or pollard sold.

3. When the nearest port is a port other than Lyttelton, Timaru, or Oamaru, the maximum price of bran or pollard as sold by the manufacturer for delivery free on board at the nearest port, on the terms of payment within seven days after delivery, shall be £7 per ton in the case of bran and £9 per ton in the case of pollard, less in each case $2\frac{1}{2}$ per cent., with such addition only as is equal to the cost of carriage by sea of a ton of bran or pollard, as the case may be, from Lyttelton, Timaru, or Oamaru (whichever cost is the least) to the said nearest port ; and in the case of sale by the manufacturer otherwise than in the manner aforesaid the maximum price shall be a price equivalent, as regards the seller, to the maximum price last above mentioned.

IV. SALE OF BRAN OR POLLARD OTHER THAN BY THE MANUFACTURER.

When bran or pollard manufactured in New Zealand is sold to a purchaser by any person other than the manufacturer thereof, the maximum price thereof shall be the maximum price as set out in the Second Schedule hereto, with such addition only to that maximum price as is herein specified, namely : (a) When sold in a quantity of half a ton or more, an addition at the rate of 10s. per ton in the case of bran and 15s. per ton in the case of pollard ; (b) when sold in a quantity less than half a ton, an addition at the rate of 12s. 6d. per ton in the case of bran and 17s. 6d. per ton in the case of pollard.

V. GENERAL RESERVATIONS.

1. Notwithstanding anything in this Order in Council, the New Zealand Board of Trade may, by order made by it, authorize the sale of flour, bran, or pollard in any specified locality, or by any specified seller, at a price exceeding the maximum price fixed by the Second, Third, and Fourth Schedules hereto by such amount

as the Board thinks fit; and nothing in this Order in Council shall apply to the sale of flour, bran, or pollard in accordance with the authority so granted by the Board of Trade.

2. Any such authority may be at any time withdrawn by the Board of Trade by order made by it.

PHYLLOXERA VASTATRIX.

NOTICE TO VITICULTURISTS.

THE following circular has been issued by the Director of the Horticulture Division :—

A recent inspection of the vines in the districts round Auckland has revealed the presence of phylloxera in a number of places. This has arisen from a want of appreciation on the part of the vine-growers of the warnings given by this branch of the Department from time to time since 1885 that phylloxera was present in the Dominion and a danger to vine-growing. The most practical effort in providing means of control was the establishment, by the Department, of the viticultural branch of horticulture at the Arataki Horticultural Station, Havelock North, Hawke's Bay, where the leading varieties of phylloxera-resistant stocks have been propagated since 1903, and many varieties of wine and table varieties grafted on them. These have been on sale to growers at much less than cost price. Some of the leading nurserymen also are now supplying vines on resistant roots. The object of this circular is to again warn all vine-growers of the danger to successful viticulture of growing any vines from cuttings—the phylloxera-resistant stock vines excepted. The present state of some of the vineyards is a proof that the non-use of resistant stocks is only inviting future trouble.

In the raising of vines worked in this way it is very necessary to see that after a season's growth the scion is not sending down roots, which it may do where the plant is put in deep enough for the union of scion and stock to come in contact with the soil. This may occur at any time should the soil be brought up to the scion. In the winter when pruning and in spring when disbudding are the times to note whether such is taking place or not. Where it is found to have occurred the roots should be cut clean away and the soil removed from where they have started, sufficiently to prevent a recurrence.

Seeing that the raising of resistant stocks and propagation of the many kinds of wine and table grapes has been carried on by the Department at great expense for the benefit of the viticultural industry, and to avoid unnecessary expenditure of money and labour in raising stock for which there might not be a demand, orders for vines must be received by the Manager of the Arataki Station during the winter months. The varieties for which orders are given will then be grafted in spring, and the plants supplied to the grower during the following winter—that is, twelve months after receiving the order. There is at present a stock of resistant one-year-old plants ready for grafting at the Arataki Station. Orders received this winter can therefore be supplied in the winter of 1921.

Although phylloxera is general in many of the vine-growing districts, it has been decided, in the interests of vine-growers, to allow them to retain those now bearing fruit for another two seasons—namely, till the planting season of July, 1922. After that date all phylloxera-affected vines must be rooted out and burned.

Applications for the purchase of phylloxera-resistant stocks (rootlings) or for grape-vines are to be made to the Manager, Arataki Horticultural Station, Havelock North, Hawke's Bay. Orders are filled in rotation of application. Payment must accompany all orders. The price of one-year-old grafted vines is £4 per hundred. For lots of fifty and over at the same rate, *pro rata*, as per hundred. For lots under fifty, 1s. per plant. For resistant stocks (rootlings) the price is 15s. per hundred, or £3 per thousand. All orders put on train at Hastings.

Introduction of Stock into Fiji.—Consolidated regulations relating to the introduction of stock into Fiji were recently issued by the Administration of that colony. The full text of the regulations was published for general information in the *New Zealand Gazette* of 8th April, 1920.

MEAT-FREEZING WORKS IN NEW ZEALAND.

Name and Address of Company. <i>Land District.</i>	Location of Works.	Beef-killing Capacity per Day.	Sheep-killing Capacity per Day.	Storage Capacity, in 60 lb. Carcases Mutton.
<i>Auckland.</i>				
Whangarei Freezing Company, Ltd., Auckland ..	Whangarei Hds.	150	1,000	80,000
Auckland Farmers' Freezing Company, Ltd., Auckland	Southdown ..	200	3,000	215,000
	Horotiu ..	200	3,000	218,000
Westfield Freezing Company, Ltd., Auckland ..	Westfield ..	200	3,000	225,000
R. and W. Hellaby, Ltd., Auckland		120	500	5,000
East Coast Co-op. Freezing Company, Ltd., Whakatane	Whakatane ..	200	1,000	140,000
<i>Hawke's Bay.</i>				
Wairoa Farmers' Co-operative Meat Co., Ltd., Wairoa	Wairoa ..	50	2,000	165,000
North British and Hawke's Bay Freezing Company, Ltd., Napier	Westshore ..	40	1,500	36,000
Thomas Borthwick & Sons (Aus.), Ltd., Christchurch ..	Pakipaki ..	30	1,500	71,000
Nelson Bros., Ltd., Tonoana ..	Tonoana ..	80	3,000	175,000
Hawke's Bay Farmers' Meat Company, Ltd., Hastings	Whakatu ..	80	2,000	155,000
Tokomaru Sheep-farmers' Freezing Company, Ltd. ..	Tokomaru Bay	45	2,500	140,000
Poverty Bay Farmers' Meat Company, Ltd., Gisborne	Kaiteratahi ..	100	2,000	300,000
Gisborne Sheep-farmers' Frozen Meat Company, Ltd., Gisborne	Kaiti ..	150	6,000	426,122
Nelson Bros., Ltd., Gisborne ..	Taruberu ..	85	2,500	100,000
<i>Taranaki.</i>				
Taranaki Farmers' Meat Company, Ltd., New Plymouth	Smart Road ..	100	2,000	135,000
Thomas Borthwick & Sons (Aus.), Ltd., Christchurch ..	Waitara ..	200	2,000	100,000
New Zealand Meat Packing and Bacon Company (Co-operative), Ltd., Wellington	Eltham ..	75	..	25,000
Patea Farmers' Co-op. Freezing Company, Ltd., Patea	Patea ..	120	1,000	180,000
<i>Wellington.</i>				
Wanganui Meat-freezing Company, Ltd., Wanganui ..	Castlecliff ..	100	2,200	160,000
New Zealand Refrigerating Company, Ltd., Christchurch	Imlay ..	200	6,000	271,000
Otaihape Farmers' Meat Company, Ltd., Taihape ..	Winiaata ..	50	1,200	125,000
Feilding Farmers' Freezing Company, Ltd., Feilding ..	Aorangi ..	100	2,200	223,534
National Mortgage and Agency Company of New Zealand, Ltd., Dunedin	Longburn ..	60	1,500	165,000
Wellington Farmers' Meat Company, Ltd., Masterton	Waingawa ..	250	6,000	353,000
Gear Meat Preserving and Freezing Company, Ltd., Wellington	Petone ..	100	10,000	415,000
Wellington Meat Export Company, Ltd., Wellington ..	Ngahauranga ..	120	8,000	260,000
New Zealand Meat Packing and Bacon Company (Co-operative), Ltd., Wellington	Kakariki ..	100	2,000	126,000
	Ngahauranga ..	160	3,000	100,000
<i>Marlborough.</i>				
New Zealand Refrigerating Co., Ltd., Christchurch ..	Picton ..	30	1,000	23,000
<i>Nelson.</i>				
Nelson Freezing Company, Ltd., Nelson ..	Stoke ..	..	350	40,000
<i>Canterbury.</i>				
Canterbury Frozen Meat Company, Ltd., Christchurch	Belfast ..	50	7,000	190,000
" " " "	Fairfield ..	..	4,000	80,000
" " " "	Pareora ..	25	4,500	230,000
New Zealand Refrigerating Co., Ltd., Christchurch ..	Islington ..	50	7,000	375,000
" " " "	Smithfield ..	50	6,000	266,000
North Canterbury Sheep-farmers' Co-operative Freezing Company, Ltd., Christchurch	Kalapoii ..	50	2,500	259,000
Thomas Borthwick & Sons (Aus.), Ltd., Christchurch ..	Belfast ..	..	4,000	126,000
<i>Otago.</i>				
New Zealand Refrigerating Co., Ltd., Christchurch ..	Pukeuri ..	..	3,000	230,000
South Otago Freezing Company, Ltd., Balclutha ..	Burnside ..	50	3,500	216,000
	Pinegand ..	30	1,200	200,000
<i>Southland.</i>				
Birt and Co., Ltd., Invercargill ..	Ocean Beach ..	100	2,500	114,000
Southland Frozen Meat Company, Ltd., Invercargill ..	Mataura ..	50	2,000	91,459
" " " "	Makarewa ..	70	2,000	73,974
" " " "	Bluff ..	..	..	114,278
Total..		4,020	132,150	7,718,362



The New Zealand Journal of Agriculture.

VOL. XX.—No. 6.

WELLINGTON, 21ST JUNE, 1920.

AN ECONOMIC INVESTIGATION OF THE MONTANE TUSSOCK-GRASSLAND OF NEW ZEALAND.

VII. ON THE EFFECT OF UNDERSTOCKING AND STOCKING TO ITS FULL CAPACITY A CERTAIN AREA.

DR. L. COCKAYNE, F.N.Z.Inst., F.R.S.

GENERAL.

THE area referred to in the title of this article is situated at about 2,000 ft. altitude on the long spur of Little Mount Peel, which descends to the Canterbury Plain. At the altitude mentioned an ordinary wire fence divides the tussock-grassland into two portions. For a considerable number of years the grassland on the one side of the fence has been treated differently from that on the other side with regard to the number of sheep depastured; otherwise the conditions to which the two areas are exposed are identical so far as light, heat, soil, slope, moisture, &c., are concerned—that is, if a narrow strip on both sides of the fence be alone considered. Here, then, occurs one of those rare but eagerly sought examples of vegetation where there is to be considered but one deciding factor, regulating its structure in this case the relative amount of stock carried on the areas separated by the fence. That is to say, if these

areas of grassland had been exposed to identical sheep-grazing the plant-covering of both would have been exactly the same—just the same, indeed, as if no fence had existed.

Coming now to this deciding factor—the relative amount of stock depastured—the area above the fence, which is a part of the Mount Peel Station, has been stocked extremely lightly for a number of years. On the contrary, the area below the fence, under different management, has—I am given to understand—been stocked for a considerable time to, at any rate, its full capacity.

The differences in the vegetation on the two sides of the fence are so striking that the most casual observer could hardly fail to notice them. These differences can be plainly seen in Fig. 1, where a general view of part of the two areas is shown. But in this photograph the fence appears as the actual dividing-line, which is misleading. The true dividing-line is situated at a couple of feet or so from the fence on its upper side, and marks the farthest point to which sheep with their heads pushed through the fence can reach the herbage (see Fig. 2). This interesting fact confirms the information I received regarding the different degrees of grazing on the pasture of the opposite sides of the fence.

The Mount Peel Range differs a good deal from most of the other mountains abutting on the Canterbury Plain, inasmuch as there are growing upon it certain species of a western character, which apparently require a rainfall higher than that of the ordinary eastern species of the Canterbury mountains. The continuous plant-covering of the subalpine portion of the range (see Fig. 3) also supports this view of the rainfall, as does likewise the taxad rain-forest which clothes some of the lower slopes, fills the gullies, and extends on to the plain. Little Mount Peel, one of the peaks of the range, attains a height of 4,200 ft. On its lower part it is clothed with rain-forest, or low tussock-grassland, as the case may be, and these are succeeded by tall tussock-grassland with a variety of the snow-grass (*Danthonia flavescens*) as the dominant tussock (see Fig. 3).

These few remarks on the general vegetation of the mountain are intended to pave the way for the special details next to be dealt with.

THE VEGETATION ON THE OPPOSITE SIDES OF THE FENCE.

Here, for sake of clearness, it is well to distinguish by name the vegetation, or pasture, on the one side of the fence from that on the other side, so that of the upper side will be denominated "lightly-grazed," and that of the lower side "heavily-grazed." But it must be remembered that these terms apply only to a girdle of not more than one chain in width on either side of the fence. This restriction is made not because the vegetation either below or above these limits changes appreciably, even for a considerable distance, but because the uniformity of the slope on either side of the fence changes, so that at a variable distance from the fence the conditions for the vegetation on either side are not identical; and in the conditions of the two areas under discussion being *identical*—save with regard to grazing—lies the crux of this article.

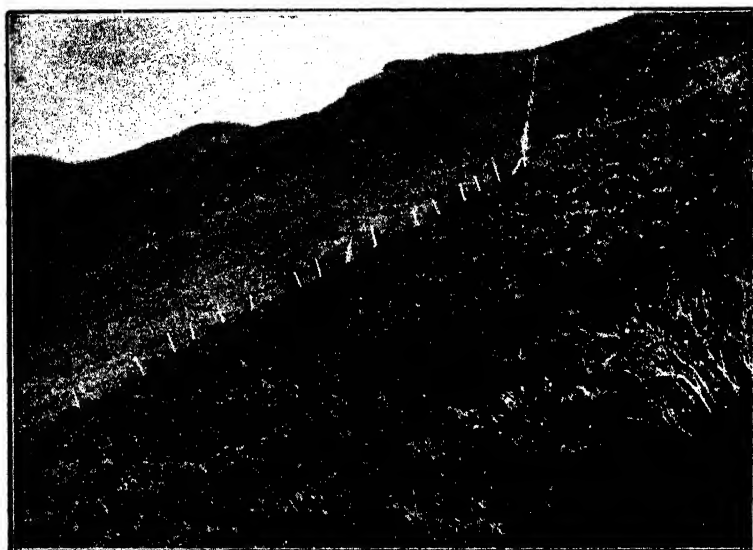


FIG. 1. GENERAL VIEW OF THE AREA ON LITTLE MOUNT PEEL.

On right of fence, the lightly grazed part; on left, the heavily grazed part.

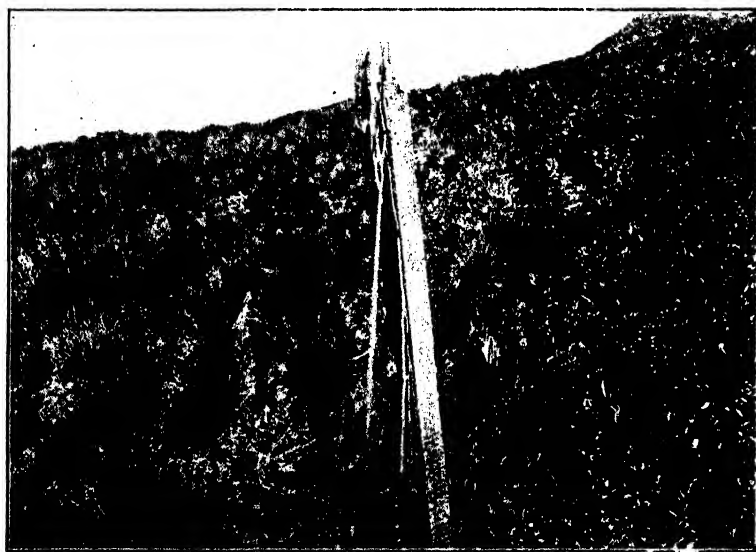


FIG. 2. CLOSE VIEW OF VEGETATION ON OPPOSITE SIDES OF THE FENCE.

Showing abundance of tutu on right (lightly grazed portion), and its absence on left (heavily grazed portion) and also as far as sheep can reach through to right of fence.

[Photos, W. D. Reid.]

Two main differences distinguish the lightly-grazed and heavily-grazed vegetation from each other. These are that, though nearly all the species which occur in the one occur also in the other, the lightly-grazed area possesses on its sunny slope abundance of tutu (*Coriaria sarmentosa* var.), which is absent on the heavily-grazed area; while on the more shady part of the lightly-grazed area there is abundance of the common cotton-plant (*Celmisia spectabilis*), which on the heavily-grazed area is absent generally, or, where it occurs, is far less common. These fundamental distinctions, as will be seen, can be directly traced to the grazing-conditions of the two areas.

The other distinctions between the lightly-grazed and heavily-grazed pastures consist chiefly of the larger size of the tussocks on the lightly-grazed area, of the smaller amount of bare ground, and of the larger quantity of palatable feed it contains. But such palatable species (e.g., white clover, catsear, sorrel, hawksbeard, Yorkshire fog, and suckling-clover) occur upon both areas, so it is clear that spelling the heavily-grazed pasture would soon increase its palatability. This apparent greater palatability of the lightly-grazed pasture is considerably reduced, however, through the amount of ground taken up by the cotton-plant and mountain-flax (here grass-land "weeds"), as also by the larger amount it contains of bracken-fern (*Pteridium esculentum*), a plant of very low palatability.

On the more shady part of the lightly-grazed area, in addition to the common cotton-plant, there is a good deal of mountain-flax (*Phormium Colensoi*) (see Fig. 5). Sometimes the cotton-plant comes up close to the fence-line, but does not extend on to the heavily-grazed area (see Fig. 6); but in places there is a small amount of this plant and also of the mountain-flax on the heavily-grazed area.

Remarks concerning Tutu.

Something must be said about the tutu (*Coriaria sarmentosa* var.), as its occurrence in quantity under extremely light grazing on the one hand, and its absence under heavy stocking of the pasture on the other hand, is the most important fact of this article.

The Mount Peel plant is that variety—as yet unnamed, unless it be *Coriaria tutu* of Lindsay—of the species the shoots of which lie down to the ground at the close of the floral year and are renewed in the spring. Below ground, but not far from the surface, there is a stout far-spreading underground stem, by means of which a plant may occupy a considerable area, so that fresh soil is ever at its disposal, while for its increase it is more or less independent of seeds. It is thus a plant capable of great aggression. This herbaceous or semi-woody summer-green form is, on the one hand, included botanically with the well-known shrub form or tree form of the forest; but, on the other hand, there is a remarkable gradation of forms connecting it with the smaller-leaved species, *Coriaria thymifolia*, while the latter similarly grades into the fine-leaved alpine tutu (*Coriaria angustissima*).

This multiplicity of forms can most likely be attributed to there being a number of tree-breeding races of tutu which readily cross one with the other. Be this as it may, the matter which specially concerns this article is that, so far as is known, all the forms of tutu contain in



FIG. 3. TALL TUSSOCK-GRASSLAND OF LITTLE MOUNT PEEL AT 2,320 FT. ALTITUDE.

Showing abundance of snow-grass (*Danthonia flavescens*), between which can be seen the leaves in rosettes of the common cotton-plant (*Celmisia spectabilis*).

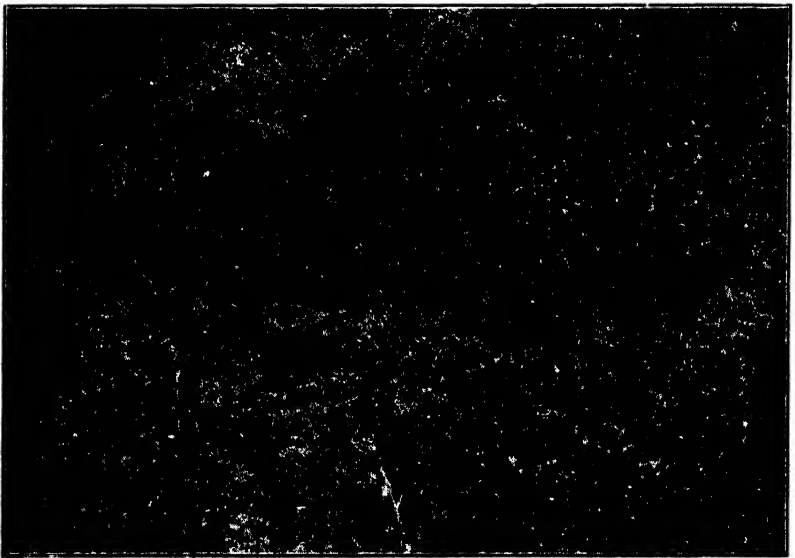


FIG. 4. VIEW OF SOME OF THE LIGHTLY GRAZED VEGETATION, SHOWING THE ABUNDANCE OF TUTU.

Tussocks and some bracken-fern can also be seen.

[Photos, W. D. Reid.]

their stems, leaves, and seeds a glucoside poison named "tutin," and that sheep have died through eating one or other of the kinds of tutin. Whether all the forms of this polymorphic species and its equally polymorphic allies are equally poisonous has not yet been ascertained. Easterfield and Aston, the discoverers of tutin, in 1901 investigated material of all three species, but at that time the idea of there being a number of distinct races had not been put forth. Theoretically, as stated already, there should be such, and it is highly improbable that all are equally poisonous. Before such a chemical problem can be attacked it is necessary to searchingly investigate the composition of the various forms of tutu from the botanical standpoint. Such work would have an obvious economic bearing. But it could not be solved by ordinary taxonomic methods; breeding-experiments would be essential.

The question as to the difference between the lightly-grazed and heavily-grazed pastures in their tutu-content seems easy to answer. The key to its solution is that small piece of ground already mentioned, 2 ft. or so across, bordering the fence on the lightly-grazed side. On this narrow strip, which is grazed just as freely as the heavily-grazed area, and is really a part of it, there are only solitary plants of tutu at long distances from one another, and all these at the time of my visit in November, 1919, gave signs of being freely eaten. Could the sheep reach farther into this lightly-grazed pasture the tutu would be doomed up to the point they could gain. In other words, sheep appear to feed upon it freely, even during the spring, when the young succulent shoots are supposed to be especially poisonous.

Can it be, after all, that tutu is a sheep-feed of high palatability? Many sheep-farmers have told me that sheep living where tutu abounds eat it with impunity. The general opinion is that it is poisonous for travelling sheep, or for those unaccustomed to it if suddenly turned on to pasture where it is in plenty. Evidently under heavy stocking it cannot persist, or it would occur equally on both sides of the fence, as do those palatable grasses and other plants which are of medium palatability or are able to tolerate severe grazing. It is quite unexpected that a plant so admirably adapted to extend its area of occupation at the expense of the neighbouring plants by means of its rapid vegetative increase, and equally rapid growth in the spring, should succumb to the attacks of sheep, but its degree of palatability and its herbaceous habit bring about its downfall. On the other hand, its subterranean parts, rich in stored-up food, render it immune to grassland fires, which, rather than damage the plant, encourage its spread.

The Cotton-plant, Mountain-flax, and Poa-tussock.

The common cotton-plant (*Celmisia spectabilis*) stands in a different category to the tutu. It is unpalatable. It, like the tutu, can defy the fire, but this not because it has an underground-stem system, but because the dead leaf-sheaths persist for many years and surround the bud—the vital part of this plant—with a thick protection of wet, half-decayed material. But why does this plant die out under heavy grazing? This is apparently does—and an excellent thing, too, to be rid of a pasture-weed. Perhaps the explanation is that, after burning, the trampling of sheep destroys the bud; also, they may



FIG. 5. VIEW IN THE LIGHTLY STOCKED AREA ON SHADY SIDE, SHOWING A GOOD DEAL OF MOUNTAIN-FLAX.

On far side of fence is part of the heavily grazed area.



FIG. 6. VIEW OF BOTH AREAS NEAR SUMMIT OF THE RIDGE.

On left (lightly grazed), the cotton-plant coming close to fence; on right (heavily grazed), only poa-tussock and fescue-tussock in evidence.

[Photos, W. D. Reid.]

eat the young leaves. In favour of this view is the fact that on rocky ground to which sheep have not access the plant remains intact, as it also does on stony spurs not readily reached by fire.

The absence of the mountain-flax (*Phormium Colensoi*) on the lightly-grazed ground may also be attributed to burning, but in its case the young leaves—its vital part—are eaten, and the plant is eventually killed in this manner.

Apparently in the lightly-grazed area there are more tussocks of the poa-tussock (*Poa caespitosa*) than on the heavily-grazed area; they are also greener in colour than those of the fescue-tussock, thus in places giving another special character to the lightly-grazed grass-land. This difference in the amount of the poa-tussock on the

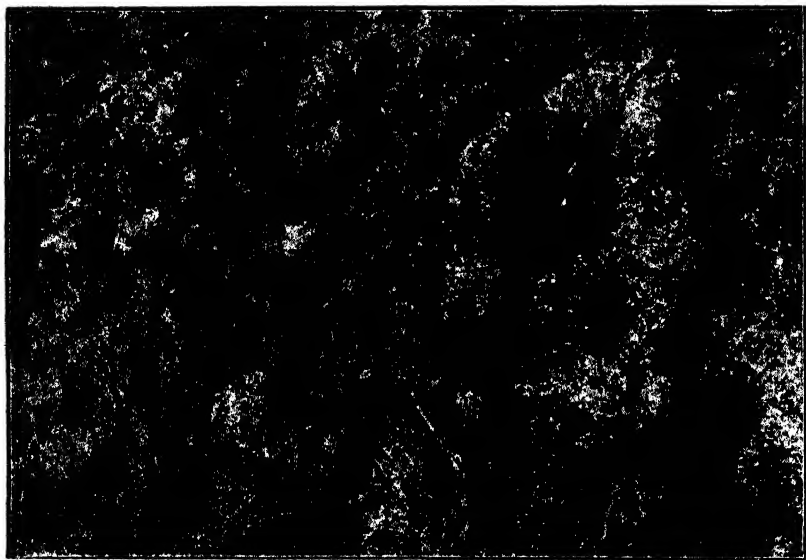


FIG. 7. VIEW OF SMALL PIECE OF THE HEAVILY GRAZED PASTURE.

The tussocks are mostly fescue-tussock.

[Photo, W. D. Reid.

opposite sides of the fence under apparently the same conditions, except those of grazing, I cannot explain. If the ground were slightly wetter on the slightly-grazed area the poa-tussock would be favoured. At any rate, the differences in the grazing cannot be of any moment in the case of so unpalatable a species. More frequent burning on the heavily-grazed area would also assist in reducing the amount of poa-tussock, but a wire fence should not arrest a grass-fire.

SUMMARY AND CONCLUSIONS.

1. At an altitude of about 2,000 ft. on Little Mount Peel a wire fence separates an area of extremely lightly grazed pasture from an area of fairly heavily grazed pasture, but the other conditions affecting the composition of the pasture of the two areas are identical.

2. The two pastures are, at first glance, to be distinguished by their entirely different appearance, and this has been brought about by the difference in intensity of the grazing to which these two pastures respectively have been exposed.

3. The differences in the physiognomy of the two pastures is due to the heavily-grazed pasture being of the ordinary low tussock-grassland type (see Fig. 7), whereas in the lightly-grazed pasture there are large quantities of tutu on the sunny slope and of common cotton-plant and mountain-flax on the more shady slope.

4. There is no tutu and very little common cotton-plant or mountain-flax on the heavily-grazed pasture.

5. Also, for a distance of some 2 ft. from the dividing-fence on the lightly-grazed area—*i.e.*, to a line marking the extreme limit sheep feeding through the fence can reach—the tutu has been eaten out except for a solitary plant or two, and these have been eaten freely.

6. From these data it appears that on pasture heavily grazed by sheep tutu cannot maintain itself.

7. Apparently sheep brought up on land where tutu is abundant can eat it with impunity, even in spring.

8. Tutu appears to possess a high degree of palatability for sheep.

9. By means of heavy stocking it appears as if tutu could be eradicated.

10. Tutu is destroyed through grazing by its leafy shoots not being allowed to develop; otherwise, through its power of rapid increase by means of its spreading underground stems, it can become extremely abundant, even in pasture which is regularly burned.

11. The absence of common cotton-plant and mountain-flax in the heavily-grazed pasture may be attributed to the young leaves which appear after burning being destroyed by the sheep.

Herb-culture.—In the herb-garden at Arataki Horticultural Station 4 bushels of stramonium-seed was recently harvested. A small quantity of henbane-seed was also saved. Belladonna has been sown again for further trial.

Lucerne and Inoculated Soil.—The Fields Supervisor, Christchurch (Mr. A. Macpherson), reports: "In South Canterbury many areas sown to lucerne have lately been inspected, and quite a number which are not thriving show on digging down and examination of the roots that there are no nitrogen-gathering bacteria or nodules on the roots, although these lands grow clovers well. Apparently the bacteria necessary for successful lucerne-production are not present in the soil, and until growers make provision for this lack by sowing soil taken from an inoculated area their experience in lucerne-growing will not be satisfactory."

DAILY VARIATIONS IN MILK-TEST.

SOME DATA FROM CERTIFICATE-OF-RECORD WORK.

W. M. SINGLETON, Assistant Director of the Dairy Division.

EVER since the inception of the factory system of manufacturing cheese and butter the yield from the milk supplied by individual dairymen has received more or less attention. In the earlier days, when payment was made on quantity alone, tests to disclose possible adulteration were in vogue, and this system prevailed generally until the introduction of the Babcock test. The general use of this test in New Zealand has superseded the earlier tests for adulteration. It has been found that to add water does not increase the payment from the factory. No system seems to be inseparable from irritating factors. Although payment for milk on the butterfat basis is generally recognized to be the best yet devised, the human element must be introduced in making the tests. The work has therefore sometimes been questioned by suppliers receiving a comparatively low test. While carelessness in the testing may justify some of these complaints, the larger proportion of the dissatisfaction is probably due to causes arising from the cows and not to the factory testing.

EQUAL DAILY MILK-YIELD WITH VARYING TESTS.

In the course of the certificate-of-record work carried out by the Dairy Division we have collected data from testing the samples of two consecutive days separately. These purebred cows are, as a class, better cared for than the individuals of an average dairy herd. Milking-hours are more regular, and care is taken in many cases to guard against such cows becoming nervously upset. Despite such precautions the variations in percentages of fat from day to day were sometimes found to be extraordinary. When the weight of milk does not vary from day to day a cow might be expected to be in a uniform state of health, and her milk uniform in quality. This may be the rule, but, if so, the following exceptions have been authenticated by our officers:—

First Day.		Second Day.		Difference.	
Milk, in Pounds.	Fat, Percentage.	Milk, in Pounds.	Fat, Percentage.	Milk, in Pounds.	Fat, Percentage.
24.0	6.1	24.0	4.4	0.0	1.7
26.9	7.3	26.9	6.1	0.0	1.2
34.5	5.8	34.5	7.0	0.0	1.2
18.9	8.1	18.7	6.3	0.2	1.8
39.8	4.2	39.5	5.8	0.3	1.6

DAILY MILK-YIELD NOT AN INDEX OF THE TEST.

Dairymen and breeders frequently assume that if the weight of milk shows a decrease for the day the percentage of butterfat must show an increase. It is assumed on this reasoning that the cow secretes a practically uniform weight of butterfat each consecutive day, although this may increase or decrease over a period. If the decrease in test be due to other than shortage of feed this reasoning appears to be unsound. If cows are in good condition, and feed be restricted for a time, the expected result may occur. If the cow is in very low condition probably the test is also below normal. The examples following show that cows on certificate-of-record test—not short of feed or in low condition—may evidence a decrease in their daily milk-weight and also a decrease in the percentage of fat as compared with the preceding or following day. Authenticated figures bearing out this contention are,—

First Day.		Second Day.		Difference.	
Milk, in Pounds.	Fat, Percentage.	Milk, in Pounds.	Fat, Percentage.	Milk, in Pounds.	Fat, Percentage.
51.8	5.0	40.9	2.6	10.9	2.4
20.6	7.6	18.1	6.1	2.5	1.5
31.4	7.3	29.1	5.7	2.3	1.6
31.8	5.3	27.8	4.8	4.0	0.5
32.8	4.3	27.4	3.1	5.4	1.2

When a cow is producing her maximum milk-yield for the day may we not assume she is feeling particularly well? If a cow is in the best of health it should not be unreasonable to expect an increase in percentage of butterfat as well as in weight of milk. Judging from figures from certificate-of-record data tabulated below, it would appear that in such circumstances an increase in butterfat percentage is not unlikely. This recalls a statement of Dr. Babcock's to the effect that cows going from stable-feed to pasture-grass in the North American spring-time are inclined to increase both in milk-yield and percentage of butterfat. The following are the figures confirming the suggestion made as to such increases :—

First Day.		Second Day.		Difference.	
Milk, in Pounds.	Fat, Percentage.	Milk, in Pounds.	Fat, Percentage.	Milk, in Pounds.	Fat, Percentage.
21.6	4.4	23.6	6.6	2.0	2.2
28.2	4.7	32.0	5.8	3.8	1.1
38.9	3.3	43.0	4.1	4.1	0.8
36.0	4.5	37.9	5.3	1.9	0.8

MENSTRUATION PERIOD.

The effect on the daily yield of milk and percentage of butterfat of the cow coming "in season" is difficult to forecast. Some cows appear to vary but little, if any; others may evidence a decrease in

milk-yield, but the test may be unaffected; while others, again, may show a normal milk-yield with a decrease in percentage of butterfat. The variations may include both milk and test. When such is the case the milk usually evidences a decrease more or less marked, and the butterfat percentages are in many instances inclined to evidence a decrease as well. The following figures represent variations at the period in question:—

Normal.		In Season.		Difference.	
Milk, in Pounds.	Fat, Percentage.	Milk, in Pounds.	Fat, Percentage.	Milk, in Pounds.	Fat, Percentage.
28.5	6.2	29.5	6.2	1.0	0.0
42.3	3.4	37.5	3.4	4.8	0.0
20.1	5.8	20.0	4.6	0.1	1.2
31.3	5.8	11.8	4.3	19.5	1.5
41.1	3.5	33.6	2.6	7.8	0.9

CHANGE OF MILKERS.

It seems to be well known that any influence which affects the cow in a manner which she dislikes will be reflected in her production. So long as the writer can remember it has been advocated that cows should, as far as possible, have the same milker at each milking. Some cows are affected very materially, while others are not so discriminating. When a variation is caused by a change of milker it is generally at the expense of the owner, the new milker usually getting poorer results. An eminent authority has stated that to get the best results from a cow the milker must take the place of the calf in the cow's affections. The evidence certainly points to the conclusion that the cow prefers old friends. Our data in this connection are, in part, as follow:—

Regular Milker.		New Milker.		Difference.	
Milk, in Pounds.	Fat, Percentage.	Milk, in Pounds.	Fat, Percentage.	Milk, in Pounds.	Fat, Percentage.
29.6	6.5	26.9	4.1	2.7	2.4
28.7	6.3	26.3	4.9	2.4	1.4

CONCLUSION.

The work carried out by the testing officers of the Dairy Division emphasizes the fact that variations occur in the butterfat percentage of a cow's milk from day to day to a degree many would not have thought possible.

The comparative quantity of milk given for the day cannot be taken as an index of the test in every case, as our figures show that when the milk-weight evidences an increase the test may show either an increase or a decrease or remain normal. Although cows when in season are more likely to yield a smaller quantity of milk than to give an increased flow, many cows vary little in this respect. The test

for the smaller yield of milk may remain normal or vary from the normal in either direction. A change of milker seems to carry with it, as a rule, a penalty by way of a decrease in milk-weight, and in many instances a reduction in the test as well.

The foregoing information is put forward with a view to assuring dairymen and breeders that when variations occur in tests for butter-fat it should not be immediately assumed that the variation is due to carelessness, lack of ability, or malice on the part of the person conducting the test.

LIME-REQUIREMENT OF NEW ZEALAND SOILS AND LIME-DEVELOPMENT.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

IN June of last year* it was decided by the Department, in view of the great value of lime as an improver of New Zealand soils, that steps by means of soil-testing under special conditions should be taken to bring home to farmers the necessity for liberally liming their lands in order to get the best results. Supplies of limestone of high quality are well distributed throughout the Dominion. A recent bulletin (Geological Survey No. 22, New Series), prepared by Mr. P. G. Morgan, Director, and other officers of the Geological Survey (which can be obtained from the Geological Survey Office, price 7s. 6d.), summarizes the extent of our knowledge concerning these deposits. There is therefore no insuperable difficulty in obtaining lime-supplies, the position being essentially different from that of phosphate-supplies, which cannot, so far as we know at present, be obtained in New Zealand in sufficient quantities to meet the demand, and therefore have to be imported.

The difficulties in connection with making available the limestone-supplies of the Dominion appear to fall into three categories. Firstly, since the high-grade deposits, ranging from 75 to 95 per cent., are so well distributed, it would, as a rule, be obviously bad policy to work the low-grade deposits, containing, say, anything from 40 to 75 per cent., except for a very limited area near the deposit or under very special circumstances. The cost of bagging, handling, and haulage of, say, 50 per cent. of inert matter is a great consideration when hundreds of tons are dealt with. Nevertheless, conditions do exist where soft limestone of low-grade occurs in which the carbonate of lime is intimately mixed with siliceous and clayey matter, and weathers down on the land to such a fine powder that in practice it has paid to use some thousands of tons of this material, which has been sieved, bagged, and carried by rail and cart over a considerable area of country.

Every case of lime-development must be considered on its merits with a full knowledge of local conditions, and those considering it should work with a local farmers' committee. Firstly, the Chemist to the

* See notice on page 331 of the *Journal* for June, 1919, which is brought up to date and reprinted at the end of this article.

Department will receive samples of alleged limestone collected from a district by farmers or Fields officers. These samples should include not only samples of limestone, but also typical soils of the district, in order to ascertain in what proportion lime is required and over what areas. The collection of the soil-samples should be left entirely with the Instructors and their assistants, as they are provided with the proper apparatus for collecting the soils, and have the requisite expert knowledge to enable them to form a better opinion as to the types of soil which exist and how to sample them. Secondly, the Chemist and his staff having selected certain deposits as suitable chemically, and determined by tests on typical soils that lime is necessary, the Geological Survey, having at its disposal several alternative sites for quarry, grinding-works, or kilns, which have been selected by those having local knowledge, makes a final selection after an examination as to the quantity of stone available and other considerations. Thirdly, the engineer is necessary in advising the best methods of obtaining and reducing the stone, or burning it, and of conveying it to the lands on which it is to be used.

It is not intended to imply that these officers are necessarily to act in the order named, or that one is more needed than another. What is aimed at is that they shall, as far as possible, act in full sympathetic concert, in order to do the best they can for the farmer and producer in making available the vast supplies of limestone at present needed by the soil. To this end it was decided to refer all inquiries and questions relating to lime-supplies to a committee consisting of the Chemist to the Department of Agriculture (convener), the Director of the Geological Survey, and the Assistant Engineer-in-Chief of the Public Works Department, as notified on page 155 of the March, 1920, issue of the *Journal*.

During the past year the Fields officers of the Department of Agriculture have been actively engaged in drawing samples of soil from various localities in their respective districts. They were instructed to select samples from lands which their judgment would lead them to suppose were typical, and to avoid mixing unlike types of soil, the general aim being to benefit as many farmers as possible through the means of each sample. Hence the instructions were to collect a few samples of representative soils rather than a larger number which only represented limited areas.

From the figures tabulated below some idea may be gathered as to the great need of New Zealand soils for lime. The method used is that of Hutchinson and MacLennan, Rothamsted Laboratory (see *Journal of Agricultural Science*, Cambridge, March, 1915). This method gives very high figures for humus or peaty soils—so much so that impracticable amounts of limestone are thereby indicated as necessary. Further, these areas occupy such a small proportion of the lands of New Zealand that they have been neglected in computing the averages. Probably humus or peaty areas will be dealt with best by some other method than attempting to satisfy the lime-requirement as indicated by the Rothamsted method, since to apply anything like 10 to 12 tons per acre to a soil is not possible under ordinary present conditions. Possibly some method of burning the top soil might prove preferable. (For an example see the account of experiments in the Waikato district, "Development of Peat Swamps," by Reynolds and Aston, this *Journal*, July, 1917.)

In considering the following table it should be borne in mind that it is quite tentative in character. It merely indicates, as an average, the net result of each Instructor's work for the year. The figures are published with a view to letting the public know that this work is steadily going forward, but that progress is necessarily slow, and reliable generalizations as to the average requirement of any one district can only be arrived at after many more samples have been collected and tested.

Number of Samples collected.	District.	Average Tons of Carbonate of Lime required per Acre.
70	Auckland	3.8
24	Wellington	1.8
6	Taranaki	2.3
8	Hawke's Bay	2.0
9	West Coast, South Island ..	4.9
14	Canterbury	1.3
16	Otago and Southland	2.3

TESTING FOR LIME-REQUIREMENT: NOTICE TO FARMERS.

In view of the great importance of lime on New Zealand soils, the present shortage of phosphates, and the fact that the use of phosphates may be economized by the application of lime, the Department will examine any soils which are properly collected by a Fields Instruction officer, for the purpose of determining the amount of lime which such soils actually require.

For this purpose it is desirable that groups of farmers, such as those forming the local branches of the Farmers' Union, or other farmers' organizations, should approach any one of the following Fields officers, and get him to appoint a date for visiting their district and for collecting typical soils for testing: Mr. T. H. Patterson, Instructor in Agriculture, Auckland; Mr. J. W. Deem, Fields Instructor, Wanganui (for Taranaki, Manawatu, and Hawke's Bay); Mr. F. E. Ward, Instructor in Agriculture, Wellington (for Wairarapa, Hutt Valley, Nelson, and Marlborough); Mr. A. Macpherson, Fields Instructor, Christchurch; Mr. R. P. Connell, Instructor in Agriculture, Dunedin; Mr. W. Alexander, Fields Instructor, Invercargill; Mr. C. S. Dalgliesh, Fields Instructor, Hokitika.

Farmers will note that—(1.) It is essential that the samples should be collected by an officer who has been specially instructed in the correct methods of soil-sampling, in order that the results of the test may be dependable. (2.) The testing of these samples, in order that it may be expeditiously performed, must be limited to the question of what amounts of lime are required per acre.

Limestones.—Samples of limestone from various localities recently tested by the Chemistry Section gave the following percentages of carbonate of lime: Seddonville, 61; Remuera, 97, 90, 88, 78; Maungaturoto, 71, 76; Longbush (Carterton), 90, 88, 94, 91, 97, 59; Port Albert, 76, 82, 57, 71, 60, 96, 75, 85, 72.

COCCIDIOSIS OF POULTRY.

LOCAL OCCURRENCE AMONG TURKEYS.

H. A. REID, F.R.C.V.S., D.V.H., F.R.S.E., Officer in Charge, Veterinary Laboratory, Wallaceville.

WITHIN the past few weeks cases of disease among turkeys in the North Island have come under the notice of the writer. Specimens of the viscera of a young turkey were forwarded to the Wallaceville Laboratory with a report stating that numerous deaths had occurred, and requesting that an investigation be undertaken with a view to determining the cause. The nature of the specimens submitted proving not altogether satisfactory, a carcase of one of the dead turkeys, and later a live bird showing symptoms of the disease, were obtained.

In an accompanying letter the owner supplied the following information regarding these cases: "The turkeys have been kept in this place for only about twenty months. No turkeys were kept here for many years, perhaps never before. The situation is high and dry, on a hilltop. The birds have plenty of ideal shelter—trees and shrubs—are never penned, and can wander as far as they like. There have been only small numbers of other poultry kept, with no trace of sickness. The turkeys were brought from —, two hens and a cock to start—strong healthy-looking birds. Almost immediately after arrival the cock showed symptoms of sickness—going off food, drooping, and passing the always present bright-yellow-coloured excreta. Although this bird went very low he recovered quickly, and has been strong and thriving ever since. There has been no sign whatever of any other disease, and no trouble in rearing the young ones, the so-called critical periods being passed without the least trouble. The birds are generally well grown before the trouble starts, and strong and heavy. Sometimes the birds after a long illness recover. I have noticed that in periods of wet weather the disease progresses more rapidly. I feel certain that the disease was in the cock bird before he came here. The hens I got with him never showed it. I do not know, but I think, that it does not affect birds after two years old."

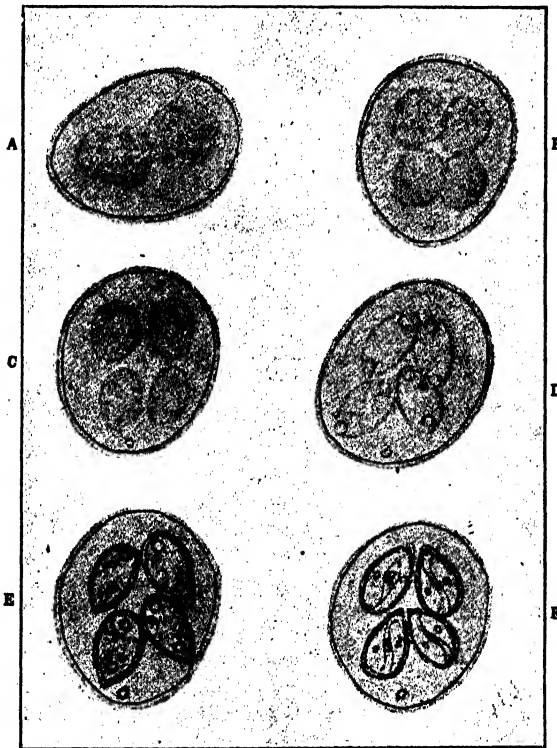
My informant states that the disease assumed virulent proportions on a neighbouring property, when twenty to thirty turkey chicks all died at about two weeks old. Those that were opened showed liver conditions exactly the same as the older birds—namely, spotted yellow. The first signs of the disease are a mopey appearance, and the invariable presence of yellow droppings. A little later the affected birds get an anæmic colour, and lose weight rapidly, though always strong weighty birds to start with. "The change for the better comes about suddenly, provided conditions are favourable. These include fine weather, good feeding, and attention. Under other conditions the birds seem to die in a short time."

Investigation led to the discovery that the trouble was due to coccidiosis. This disease is set up by a minute animal parasite—*Eimeria*

avium—belonging to the group of protozoa known as sporozoa. These organisms invade the digestive organs of the infected birds, producing lesions which frequently result in serious mortality.

LIFE-HISTORY OF THE PARASITE.

The life-history of the sporozoa is complex, and a short account may be of interest to some readers. These parasites are capable of passing both sexual and asexual stages of existence. As seen by microscopical observations of preparations made from the excreta of diseased birds, they appear as ovoid cysts filled with granular contents within a transparent membrane or shell, which under a sufficiently high power of magnification is seen to possess a double-contoured outline. This is the so-called oocyst stage, a resistant form which for a time inhabits



OOCYSTS FROM CHICKEN, AFTER INCUBATION AT 75° TO 80° F.

(Drawing not to scale.)

At A, after forty-eight hours. At B four sporoblasts are shown within the oocyst. C and D, after seventy-two hours, showing further developmental stages of sporoblasts. E and F, after the fourth day at 75° to 80° F. Sporocysts with double-contoured resistant coverings lying within the oocyst. At F, each sporocyst contains two sporozoites and some residual matter.

[After Jowett, in *Journal of Comparative Pathology*.]

the cells lining the mucous membrane of the bowel, into which it had penetrated at a former stage of existence.

The oocyst escapes with the excrement; and outside the body, under certain favourable conditions of temperature and humidity, it commences to undergo further changes. Should the necessary conditions for further development not be met with the oocyst can remain dormant, protected by its strong shell, until a more favourable opportunity arrives. It has been estimated that these bodies are able to resist destruction from natural processes for months, and even as long as two years, this vital property constituting one of the most difficult features in combating the disease.

Given the necessary factors for its development, the contents of the oocyst undergo differentiation into four spherules called sporoblasts. Each sporoblast in its turn undergoes changes to become a sporocyst, and now appears as miniature oocysts, each surrounded with a double-contoured membrane lying within the larger parent cell. Each sporocyst now divides into several sporozoites. The original oocyst containing the sporozoites, being taken in by the bird with its food or water, is introduced afresh into the bowel, where, by the process of digestion, it ruptures, setting free the sporozoites.

These sporozoites are capable of moving freely; they fix themselves to the cells lining the intestine, and finally penetrate them. The sporozoite grows at the expense of the invaded cell, and undergoes gradual transformation into a number of minute bodies known as merozoites. The cell ruptures and liberates the merozoites. These in turn penetrate other intestinal cells of the host, and by a process of division form new merozoites. The newly formed merozoites, after penetration of fresh cells, may in some instances become female elements (macrogametes), and in others male elements (microgametes). The macrogamete is fertilized by union with a microgamete, and the fertilized cell then gradually develops into an oocyst—to recommence the cycle.

OTHER FACTS.

Some authorities (Theobald Smith, Cole and Hadley, Hadley and Amison, and Jowett) describe an organism which they consider to be responsible for the disease commonly known as "blackhead" in turkeys. This organism was named by Smith the *Amoeba meleagridis*, and Jowett considers it to represent a "stage in the life-cycle of a flagellate, in all probability a trichomonad, present in the intestinal contents of the bird.* The parasite described in Jowett's article was also seen to be present in the cases under review. No amœboid movements, however, could be observed; and in view of the presence of very numerous coccidia it was considered that one either had to deal with a mixed infection, or that, as held by some, the *Amoeba meleagridis* merely represents a stage in the development of a coccidium. The opinion that coccidia are responsible for this infection also finds support from H. Gray in an article on the subject of coccidiosis published in 1913.† Blackhead, it should be remarked, appears to be a rather unfortunate

* "Blackhead: Infectious Entero-hepatitis or Typhlo-hepatitis—a Disease of Young Turkeys," by Walter Jowett. *Jour. Comp. Pathology*, 1911.

† "Coccidiosis of Birds," by H. Gray. Published in "A System of Veterinary Medicine," Vol. 1.

popular term used to describe this disease affecting turkeys. This symptom is by no means constant, and nothing like the density of colour implied by the term was observed in any of the cases examined by the writer.

It has been noted by certain investigators (Cooper Curtice in America, and Jowett in Cape Colony) that chickens may harbour the parasite (*Amoeba meleagridis*) without showing symptoms of disease, and that they may act as disseminators to the more susceptible turkeys with which they may come in contact. It is considered inadvisable, therefore, to attempt to farm fowls and turkeys on the same ground; at any rate, if possible, the young turkeys should not be allowed to mingle with other poultry.

The disease in birds is known under the terms spotted liver, black-head, dysentery, and more technically as infectious entero-hepatitis. The first account of this disease is ascribed to Rivolta, who in Italy, in 1878, reported its occurrence among domesticated and wild birds. More recently the disease has been recorded by various investigators, among whom may be mentioned McFadyean, Moore, Cooper Curtice, Raillet, and Jowett. Jowett, in an article published in 1911, reports the disease as occurring in Cape Colony, where it is responsible for heavy losses among poultry, as many as 60 or 70 per cent. of young chicks dying from this infection.* According to the findings of a commission appointed some years ago to inquire into the mortality of grouse in Scotland, coccidia were implicated in producing the greatest fatality among grouse chicks.

CONTAGION.

Among poultry coccidiosis is usually set up by the introduction of a newly purchased bird harbouring the parasite. Soiled eggs, or eggs which may actually contain the parasite, are also responsible in some cases for conveying the disease. Old crates, second-hand fowl-houses, and incubators are also fruitful sources of contagion. In New Zealand rabbits are frequently infested by coccidia, and it has been suggested that these are capable of setting up infection in birds. The evidence on this point is very doubtful. As a rule, parasites, even of the same species though differing in variety, are incapable of producing disease in animals of species other than their normal hosts. In this respect they are strictly selective, and will only multiply in the particular host to which they belong.

Coccidiosis, so far as I am aware, has not hitherto been recorded as occurring among birds in New Zealand, though it may be pretty widely distributed. There is a general opinion in this country that turkeys are most difficult to rear. Quite apart from the loss inflicted by stoats, weasels, and hawks, deaths among the younger birds are of frequent occurrence. The disease may occasion heavy loss among chickens and fowls, though, so far, it has not come under the observation of the writer. The possibility of its presence, however, should not be overlooked whenever mortality occurs amongst birds of any species, especially if any of the characteristic symptoms are in evidence.

* "Coccidiosis of the Fowl and Calf," by W. Jowett, Department of Agriculture, Cape Town. *Jour. Comp. Pathology*, 1911.

SYMPTOMS.

As regards the symptoms, there is little necessity to amplify what has been related in the opening paragraphs of this article. In chickens a few days old the disease assumes very virulent proportions. The chicks stop feeding, cry incessantly, and move about restlessly. The colour fades from the comb or beak, and they soon die. At this early age the symptoms of diarrhoea, which characterize the disease among older birds, may be altogether absent. In older chickens and young turkeys the birds appear to mope and waste away. The droppings are of a chalky appearance, gradually changing to bright yellow, and becoming more fluid in consistence. In the later stages they are mixed with blood and mucus. The comb and wattles of poultry, and the featherless parts of the heads in turkeys, lose their bright hue, becoming leaden or almost blackish in colour. The sick birds may appear bright about the eye until within a few hours of death. On removal of the feathers the carcase is seen to have been reduced to mere skin and bone.

Turkeys between the ages of three weeks to three months appear more susceptible to attack. The mortality is heavy, but some of the affected birds may recover. The recovered birds may harbour oocysts for a considerable time after their apparent return to health, and may convey the disease on to fresh pastures and fatally infect younger or more susceptible subjects.

It is stated that the coccidia may be present in the albumen of eggs derived from affected hens, the parasite gaining access before the egg reaches the shell-forming portion of the oviduct. Such instances may account for the mortality among brooder-reared chicks, when other means of infection are remote or cannot be accounted for.

POST-MORTEM APPEARANCE.

On opening the carcase of a bird dead of this complaint the belly cavity is found sometimes to contain a quantity of blood-stained serous exudate, which may cause adhesions to form between the various organs in this situation. The most striking feature is the changed appearance of the liver. This organ is generally enlarged and much congested. Upon its surface appears circumscribed patches varying in size from a pea to a sixpence. Occasionally these patches may have become confluent, forming an irregular discoloration upon the surface. These areas are of a darker colour than the surrounding liver-tissue, and very often present a yellowish centre. Sometimes the patches are of a uniformly yellow tint. They involve to a very slight extent only the depths of the liver-tissue.

The intestines are filled with yellowish or yellowish-green faeces mixed with mucus. In some cases numerous stones and pebbles are found in the lumen of the bowel. The caeca, or blind guts, are markedly altered in appearance. They are congested, and the walls of one or other are very much thickened. The interior is filled with cheesy blood-stained concretion adhering to the mucous surface of the bowel.

Microscopically, the blood of affected birds shows a very well-marked and characteristic increase in the number of certain of the white blood-cells—the eosinophile leucocytes. This appearance of the blood is common to most parasitic infections, and forms a useful guide in cases of parasitic disease.

Microscopic examination of preparations made from the droppings or contents of the bowel shows the presence of numerous oocysts in varying stages of development. Similar examination of the diseased bowels shows the parasites lying within the epithelial cells. The tubules of the mucous surface of the bowel are often distended by the parasites, some are ruptured, and the epithelium is destroyed. Sections through the discoloured areas of the liver also determine the presence of the parasite on microscopic examination.

TREATMENT.

In the event of any poultry or other domesticated birds dying or showing symptoms corresponding with those narrated they should be at once isolated and steps taken to ascertain the nature of the malady. Communication with any of the Department's live-stock officers will ensure the necessary assistance to this end. Sick birds should receive the best of feed and attention, the object being, as in all parasitic infections, to render the natural powers of resistance of the host able to withstand the parasitic invasion. Warm new milk should be offered, and mashes prepared with milk in place of water. Fresh clean drinking-water should at all times be accessible. Valuable birds may be given such delicacies as finely chopped-up hard-boiled eggs and meat. Coarse indigestible foodstuffs should be avoided. Grain should be given crushed or steeped in milk. Bran is better withheld.

As regards medicinal treatment little can be said with confidence. Among the various agents recommended are sulphate of iron (10 grains to the gallon of water) and permanganate of potash added to the drinking-water until it attains a pink colour. Kerosene or oil of turpentine mixed with the food is said to be efficacious. Catechu has also been recommended, given in the drinking-water in the proportion of 10 to 15 grains to the gallon for the larger species, and continued for ten to fourteen days. If oocysts are still present in the faeces the treatment is continued, giving 5 to 8 grains of crude catechu to the gallon of water until symptoms decline and the parasites cease to appear in the droppings. Morse and Jowett have tried treatment by means of sulphate of iron and salicylate of soda. The iron is given dissolved in the drinking-water in the proportion of 10 grains to the gallon, while the salicylate of soda is given in pill form—2-grain to 3-grain doses—every evening. The results following this treatment have varied, though Jowett considers that on the whole it has been of some slight benefit.

The measures suggested by the English Board of Agriculture, and referred to by Jowett, comprise the following recommendations:—

1. Owing to the difficulty and practical impossibility of disinfecting a poultry-run a change to fresh ground is necessary. If, however, the infected stock is moved to fresh ground, that ground will rapidly become infected. The old stock should therefore be left where it is, any birds which show symptoms of the disease being promptly killed. Only newly hatched chicks should be placed on the new ground, and all brooders, coops, feeding- and watering-utensils should be thoroughly disinfected before use. There must be no communication with the old infected yard.

2. If hens are used for hatching there is a danger that they may infect the chicks; but if hens are preferred, then broody hens must be

purchased from clean stock. Some of the infected hens may deposit coccidia on the shell of the egg, and if the disease has attacked their oviducts coccidia may be found inside the egg. In either case the young chick may become infected and suffer from the disease known as white diarrhoea of chicks. All eggs before being set should therefore be dipped into a solution of 90 per cent. of alcohol and 10 per cent. of water.

3. If these suggestions cannot be carried out, or if fresh ground cannot be provided, the best procedure is (a) to kill all birds exhibiting the first symptoms of the disease; (b) to take off about 3 in. of the top soil of the most frequented parts of the runs, and disinfect or burn it; (c) to disinfect thoroughly all houses, roosts, laying-nests, food and water utensils; (d) to use only healthy hens for setting; (e) to place eggs in a solution of 90 per cent. alcohol before setting them.

For the general cleaning-up and disinfection of coops, buildings, &c., frequented by the diseased birds it is advisable to wash them down with boiling water containing a little ordinary washing-soda, and finally to limewash them, using the limewash while hot.

ERADICATION OF SILVER-FERN.

It is generally admitted that the control on broken country of silver-fern (*Pteris scaberula*), which occurs so freely throughout the King-country of the North Island, and elsewhere, presents a difficult problem—far more so than in the case of the ordinary bracken-fern. From the experience of settlers and the writer's own observations it would appear that there are only two effective methods of treatment. The first method is to subdivide the area, and stock heavily with sheep or cattle according to the conformation of the land, but the more cattle the better. If possible there should be three paddocks, and the stock should be ten days in each, or ten days on and twenty days off. The number of stock should be regulated so that they will have fair feed for, say, seven days, but during the last three days will have to work for their living. As the patches of fern are crushed out they should be surface-sown with a heavy seeding of grasses suitable to the district. If the land is steep the mixture should contain a large percentage of *Danthonia pilosa*. The other method is to fire the patches of fern. This can sometimes be done in the early spring after a few frosts when the sap is right down, but the best and safest time is about the end of March. It is necessary that the fern be very dry so as to ensure a good hot fire, a poor fire doing more harm than good. For this reason considerable judgment is necessary in burning, and if the conditions are not ideal one should wait, even if it means missing a year, rather than risk a bad burn. As soon as the ashes are cool apply a heavy seeding of grass-seed as recommended under the first method. It is very important that the seed be sown before rain has fallen. A great deal of the success of the operation depends on this. The foregoing note was prompted by an inquiry from a King-country correspondent who used the name silver-fern. *Pteris scaberula* is also variously known as carpet-fern, creeping-fern, hard-fern, and pig-fern.—J. W. Deem, *Fields Instructor, Wanganui.*

MORTALITY AMONG STONE-FRUIT TREES IN CENTRAL OTAGO.

A RECENT INVESTIGATION.

G. H. CUNNINGHAM, Biology Section.

AN investigation of the causes of a marked mortality or stunted growth among stone-fruit trees in Central Otago was undertaken by the writer in conjunction with other work during a recent visit to that district with Mr. J. H. Thorp, Orchard Instructor. The trouble in question is more or less general throughout Central Otago, but is specially marked in the localities of Ettrick, Roxburgh, Alexandra, Clyde, and Cromwell.

In some orchards only an occasional dead tree was observed; in others whole blocks were more or less affected. Apricots appear to be the most susceptible—the variety Moorpark particularly so; next in susceptibility comes the nectarine; then the peach. Apples, pears, and cherries appear to be but little affected.

The causes of this mortality appear to be many and, in some instances, hard to define. We found dead trees in low localities where drainage was poor, and in high parts where the drainage appeared to be good; odd affected trees scattered among a block of perfectly healthy trees, or whole rows or blocks affected; in irrigated and unirrigated areas, cultivated and uncultivated areas, &c. In the majority of cases, however, the death of any one particular tree could be traced to one of the three following factors: (1) Excess of water in the soil; (2) unsuitable soils; (3) fungous diseases.

EXCESS OF WATER IN THE SOIL.

This excess is largely caused through faulty irrigation, or through flood-water, abnormal rainfall, &c. By far the greatest number of dead or dying trees occur in orchards constantly irrigated. This was so apparent that we inquired fully into the method of irrigation in vogue. The method most commonly applied appears to be as follows:—

The water is led from the main races to smaller races which lead on to the higher ground in the vicinity about to be irrigated. Small channels, usually made with a plough, are run, one on each side, down the lines of trees as far as the natural fall will carry the applied water. Into these channels the water is led and allowed to run until it reaches the farther end, where it either remains and forms pools or (rarely the case) is led away by a farther channel ploughed for this purpose, which runs at right angles to the channels used for irrigating. The water may be run into the channels only for such time as it takes to reach the end of the line of trees being irrigated, or may be allowed to run until the orchardist is satisfied that the soil is well saturated, this last being the method favoured by the majority. Needless to say, as the surface of the ground is more or less undulating, due to the method of ploughing, the quantity of water received varies greatly in the case of

different trees. In some places there may be a slight depression, this naturally becoming filled before the water continues down its allotted channel; other places, again, will receive but little water, as they may be on high ground.

No provision is made for soil-drainage, the orchardist usually being under the impression that the soil is sufficiently porous to carry away the surplus water. This is rarely the case, as in a large number of orchards visited a hard-pan underlying the surface soil was observed. This hard-pan was usually in the form of a white concrete-like mass, varying in thickness and occurring at varying depths in the soils in question.

Where water had accumulated in slight depressions, or where the soil had become saturated owing to the proximity of the hard-pan to the surface, we invariably found dead trees. Many cases were observed of trees that had been subjected to an excessive amount of water, and had perished as the result. In one instance a block of about an acre had been flooded by the bursting of a race. Although the water had been on this land only for about a week, it was noticeable that the greater number of the stone-fruit trees had succumbed. Apples and pears, on the other hand, were but little affected by this particular flooding. Cases where one or two trees had died, the remainder of the trees in the orchard being quite normal, were investigated, and invariably one could trace the cause of death to the effect of excess water which had seeped from adjacent races.

A plentiful supply of oxygen is necessary to enable a plant to perform the phenomena of cell-division, respiration, and other functions associated with plant-life. This oxygen is obtained from the atmosphere, and to a lesser extent from the air in the soil and the soil-moisture. A porous well-cultivated soil favours the admission of oxygen to the plant root-hairs, while a close, tenacious, compact soil hinders it. When the soil becomes saturated with water the air is driven out. If this excess of water remains but a short time no harm is done to the plant, as it is able to obtain the necessary oxygen in solution from the water. Should the excess of water persist beyond a very short period the oxygen in solution becomes exhausted (the water becomes "stagnant") and the plant root-hairs die, as the protoplasmic contents are only able to live and perform their functions when this essential element is present.

It is obvious that, as excessive moisture is one of the causes, some provision made for the removal of this excess would tend to prevent a recurrence of the trouble. Subsoil drainage would, by rendering the soil more pervious and by preventing water lying in pools round the trees, probably be the most effective remedy. Where one or two trees have died in patches, one or two drains in their vicinity would suffice. The breaking of the hard-pan with explosives would certainly have a beneficial effect.

UNSUITABLE SOILS.

Many of the orchards now suffering the loss of a large percentage of stone-fruits are planted on soil that is quite unsuitable for stone-fruit culture. The old idea that any soil is suitable for fruitgrowing has never proved more fallacious than at the present time. Many acres of stone-fruit trees have been planted on poor gravelly soils.

For a time the trees have thriven, but as soon as they have utilized the available plant-food in their vicinity they have gradually become stunted and weakened, and have either died outright or become an easy prey to the attacks of various fungi. With trees on this class of soil one can do little, as at best they will be stunted and incapable of bearing a profitable crop. It would be more profitable to use the soil for other purposes.

Beginners before purchasing or planting would do well to consult the Orchard Instructor for the district as to the suitability or otherwise of the land they intend to purchase or plant.

Many acres of orchards have been planted on land that appears to be first-class orchard land; but in a few seasons trees on this land become more or less stunted, and make but little growth. As a rule, this stunting is not general, the major number of the trees planted being perfectly normal and healthy, while in small patches here and there amongst them a few trees become so stunted as to appear in marked contrast to their vigorous growing neighbours.

At the time of our visit these patches of stunted trees were very noticeable. Some appeared to be affected this season for the first time; others, again, appeared to have made but little growth since being planted.

Trees may be wholly stunted or merely have one or two branches affected. These affected branches (or the whole tree, as the case may be) are much weaker than normal, have fewer leaves, the leaves being usually smaller, of a yellowish colour (chlorotic), strongly incurved, and as a rule decidedly brittle. They are, as a rule, badly infected with powdery mildew (*Podosphaera oxycanthae* De Barry). Frequently the greater number of the fruit- and leaf-buds are too weak to perform their functions, and produce but few leaves and few flowers, which fail to set fruit.

Presence of Alkali Compounds.

The cause of this stunting (and sometimes dying outright) is the presence in the soil of varying quantities of one or more compounds which create that class of soil known as "alkali." Many of the orchards are planted on the sites of old conservation dams which were used for sluicing. These alkali compounds, being as a rule readily water-soluble, have been brought in by water-races running through strata in which these compounds occur (this alkali country appears to be fairly plentiful in the surrounding hills), and have gradually through the years accumulated in these dams by sedimentation, evaporation, &c. Again, natural depressions in the ground have been gradually filled up by soil, &c., brought down by rain-water. Alluvial fans deposited from the adjacent hills would in a lesser degree contain quantities.

Trees planted on the old sites of these dams or depressions would to a greater or less extent suffer from the alkali contained in the soil, according to whether they were near the periphery or centre of the dam or depression. The water at present used for irrigating, if running through these alkali strata (and we found many races did so), would also bring these salts in solution, and gradually increase the soil percentage. Where irrigation pools have formed round the trees these salts would gradually be deposited through evaporation of the water. This is apparent in many places where trees have been killed outright.

Where there is not too great a quantity of alkali in the soil, and where irrigation is practised, the remedy would be a thorough system of subsoil drainage. These drains would serve to carry off the surplus water with the alkali in solution. Irrigation without drainage causes a worse alkaline condition by bringing to the surface subsoil alkali, and by allowing a greater accumulation from the supply in the irrigating water. Where irrigation with subsoil drainage cannot be resorted to an application of gypsum may prove beneficial.

Where the alkali patches are marked, fruitgrowing would be a very hazardous occupation, as it is doubtful if the trees would succeed. On one block of about half an acre that had been planted with both stone and pome fruits the soil was markedly alkaline, and every tree succumbed. Crops of beet, mangolds, cabbages, asparagus, &c., can, however, be successfully grown on these patches.

FUNGOUS DISEASES.

Many dead or dying trees were observed growing on what appeared to be good well-drained soil free from alkali. Closer examination of branches, &c., of these affected trees frequently revealed the presence of fructifications of fungi, two of which occurred so frequently that we were led to believe that they may be associated with the dying of these particular trees. Specimens of these fungi were collected from various trees in the various districts, and were taken to the Biological Laboratory, where they were microscopically examined.

These fungi the writer has identified as follows: (a) *Valsa leucostoma* (Pers.) Sacc.; (b) *Nectria cinnabarina* (Tode) Fries.

Valsa leucostoma.

The conidial stage of *Valsa leucostoma*—known as *Cytospora cincta*—has been known for many years as a parasite of stone-fruit trees. It is only an active parasite where the tree has become previously weakened by frost or other injury. Fructifications were collected from dead branches of peaches, nectarines, and apricots.

The presence of this disease is usually indicated by the wilting of a branch or limb of the infected tree. At or preceding this wilt stage masses of gum appear on various parts of the infected branches, usually at the base of the wilted portions. At a later stage minute pustules appear on the dead areas. From these pustules thread-like pinkish tendrils, often an inch or more in length, are produced. These tendrils consist of myriads of very minute spores, each spore being about $\frac{1}{100}$ in. in length, embedded in a gelatinous substance.

This gelatinous substance is readily water-soluble; and when dissolved the spores are freed to be carried by rain, wind, &c., to other parts of the tree or to other trees, where, given favourable circumstances, they are capable of starting the disease afresh. Birds may also assist in this spore-dissemination, for the spore-bearing tendrils are viscid, and may become attached to the birds' feet when they alight on affected branches, and so become carried from tree to tree.

This fungus is not directly capable of attacking any branch, but can readily infect through wounds, dead shoots, frost-injured portions, &c. It is significant that on a great number of the trees examined numbers of dead lateral shoots were present. Many of these laterals had been

killed by spray injury, but the greater number had succumbed through being immature, the result of a prolonged mild autumn—during which they had retained their foliage and continued growing until the first frosts—followed by a severe winter.

A large percentage of the trees were first attacked through these greatly weakened or dead laterals. The fungus, once it has gained a footing on such trees (which have been weakened by the great loss of leafage, caused by the large amount of dead laterals), soon makes its way into the larger branches and kills them outright. Death is brought about by the mycelium of the fungus blocking the conduction vessels, preventing the passage of water, &c.

Control measures are difficult, as once the fungus has entered the tissues spraying with the usual fungicides would be of little avail.

As the fungus can only attack a tree that has become weakened or is carrying weakened or dead laterals, anything that can be done to give the tree greater vitality—such as thorough cultivation, judicious applications of manure, &c.—would be in the nature of a remedial measure. Trees growing on poor soils, especially soils that have an underlying hard-pan, are very susceptible to the attacks of this fungus. Here applications of manure, breaking of the hard-pan, &c., would prove beneficial.

As it has been pointed out that one source of infection is through weak or dead laterals, anything that will induce normal lateral growth which will be properly ripened before the dormant season will be a great aid in combating this disease. Judicious pruning, and thinning-out of lateral growth, particularly water-sprouts, the removal of all dead twigs, and painting-over of large wounds, should be practised. Where branches have been infected they should be cut out and burned. The wounds made should be then dressed with a disinfectant, and painted over. A good disinfectant to use would be corrosive sublimate, 1 part to 1,000 parts of water.

Nectria cinnabarina.

Apricots, and to a lesser degree peaches, suffer a good deal from the attacks of this fungus. The appearance of affected trees is somewhat similar to those attacked by *Valsa leucostoma*. Branches, apparently healthy and carrying a good show of foliage, suddenly wilt and die in a very short time, the foliage and fruit shrivelling and remaining on the infected branch for a considerable time after it is dead. Some little time before the wilt stages patches of gum appear in various places on the branch. Microscopic examination of the tissues in the vicinity of these gumming patches invariably reveals the presence of quantities of fungous mycelium, which appears to block the conduction vessels. Large cracks in the bark frequently appear near these gumming areas, probably the result of ruptures in the cortex caused by masses of gum bursting through.

Following the death of the branch, pustules of the fructifications of the conidial stage of the fungus (*Tubercularia vulgaris*) burst through the cortex. These are at first a pale pink, but soon change to a deeper shade of pink. This fungus is a common saprophyte, and may be found on a large variety of dead wood, but it is capable of becoming an active parasite if given favourable opportunity. Excessive gumming and

subsequent cracking of the bark, wounds caused by the removal of large limbs, plough injury, splitting of branches where they join one another, &c., all afford an opening for the ingress of this fungus. Excessive gumming is largely caused through unfavourable soil conditions, such as excessive soil-water, poor light gravelly soils, &c. This trouble is particularly noticeable on poor ridges.

Remedial measures would be similar to those mentioned for *Valsa leucostoma*.

DEFECTIVE NURSERY STOCK.

Many young trees that had died the season they were planted were examined, and in the majority of cases these trees were seen to have been very poorly worked in the nurseries, as large wounds were noticeable on the stocks where they had been budded. Many of these trees had been twice worked, and two or more large gaping wounds, which, owing to the greatly weakened state of the trees, would have but little chance of callusing over, were noticeable. These wounds afford such an excellent opening for the fungi which have been described that growers would do well to refuse any such trees inadvertently forwarded by nurserymen.*

CONCLUSION.

From the foregoing it is evident that excessive soil-water plays an important part in the causes of the mortality amongst stone-fruit trees in Central Otago. This excessive water may be due to faulty irrigation, floods, abnormal rainfall at any particular period, &c. This trouble should be largely rectified by some method of subsoil drainage. It is significant that the fungi mentioned are only able to become markedly parasitic where trees have become weakened or injured in some manner. No doubt excessive water has had a good deal to do with this condition.

* Inferior trees, such as those referred to, should in any case not be accepted by the orchardist, as they do not comply with the provisions of the fruit-tree-grading regulations.

The Opossum Question.—At the annual meeting of the Wellington Acclimatization Society, held last month, the president expressed the opinion that an opossum season should be opened under license in suitable districts. Professor H. B. Kirk had gone into the whole question very fully. In a fruit district the opossum should not be protected, but in native bush they did no damage. Damage was done to native bush by pigs, deer, and particularly by cattle. Authority should be given to trap opossums by license, the fees to go to societies. Revenue from opossum licenses on Crown land might be used for the benefit of scenic reserves. The conclusions of Professor Kirk were that opossums did do damage to orchards, and in fruit districts there should be an open season perpetually. Although plantations were liable to suffer, the native bush did not suffer appreciably, and might be heavily stocked. The opossum trade was valuable, and might be made more valuable still by development. Licenses should be issued to trappers, and the mountain-ranges should be stocked with the best Tasmanian brown opossums.

LUCERNE ON RIVER GRAVEL AND ON COASTAL SAND.

F. E. WARD, Instructor in Agriculture, Wellington.

THE fact that lucerne will not stand "wet feet" can only be said to apply to stagnant water, for on a recent visit to Marlborough fields were inspected which grew excellent lucerne down to the water's edge of streams. The accompanying photograph shows lucerne growing on pure gravel in the bed of the Flaxbourne River, on the property of Mr. Alex. Thomson, of Ward. This lucerne has been covered with water several times since being sown, the last time to a depth of several feet (a few weeks previous to the photo being taken), on which occasion the shingle shown in the foreground was deposited. The



LUCERNE GROWING ON GRAVEL IN BED OF FLAXBOURNE RIVER.

[Photo, D. Wilton.]

method of establishment is sowing broadcast on the shingle after floods. This shingle is of a calcareous nature, whitish in colour, the situation being at the foot of a limestone hill.*

An interesting case of lucerne growing on the sea-front at Ward, a few feet above high-water mark, also came under the writer's notice. An area at the foot of the hill above the beach, composed of mere sand and growing tauhinu and other rubbish, has been fenced off, cleared, disked, and sown with lucerne. Wherever the sand remained fairly stationary the plants have become well established. Marram-grass has now been planted with the idea of holding the sand when further lucerne-seed will be broadcasted among it. There is a good prospect that a waste area will thus be converted into remunerative grazing.

* See also *Journal* for February, 1916, page 110.

IMPORTATION OF FERTILIZERS.

ANNUAL STATISTICS AND REVIEW.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

STATISTICS of artificial fertilizers imported into New Zealand during the year ended 31st March, 1920, are now available, and have been specially compiled for the *Journal* in the accompanying tables.

Comparing the 1919-20 figures with those of the previous twelve months, it will be noticed that there is a considerable improvement in the quantity of all phosphates imported, except in the case of superphosphate, of which some 5,500 tons less were received.

Considering the phosphates categorically in the order in which they are stated, bonedust shows a considerable decrease in the last three years, although in pre-war times there was also a progressive decrease, doubtless owing to competition of other phosphates. The decrease in war years must be referred to other causes.

Basic slag in the pre-war years showed highly progressive increases in the figures, rising from 8,600 tons in 1911 to 30,350 tons in 1914. As this is pre-eminently a pasture top-dressing fertilizer suitable for most climates, the decline in its importation has been one of the most serious war-time shortages for New Zealand. The figures show the importation to have sunk to nil in 1918-19, but there was some revival in 1919-20, when 2,759 tons were imported.

The importation of superphosphate before the war was a fairly constant quantity. While it could be obtained from Australia the demand for a quick-acting fertilizer led to an increase in the imports in 1915 and 1916. From this time the figures show a great decline—from 58,000 tons to 15,000 tons in 1919-20, which is less than half the pre-war figures.

As against these decreasing quantities it is satisfactory to be able to record an increase in the importation of "guano," or what is really rock phosphate, the figures for the war years being greater than any hitherto recorded. The phosphate in rock phosphate is, of course, in the insoluble form, but it is anticipated that when it is finely ground it will be valuable for many purposes for which basic slag and even superphosphate are now used. To the credit side of the fertilizer position in New Zealand must also be placed the arrival in war years of the new phosphate from Egypt under the trade-name of Ephos, or Egyptian phosphate. The use of this fertilizer commenced in New Zealand in 1916, when the first cargo of 2,000 tons was received. In the 1918-19 twelvemonth, owing to war conditions, no Ephos arrived in New Zealand, but with that exception every year has shown a steady increase in the quantity imported, culminating in 15,000 tons for 1919-20.

SUMMARY OF KINDS, QUANTITIES, AND DECLARED VALUES OF FERTILIZERS IMPORTED DURING YEARS ENDED 31ST MARCH, 1919-20 AND 1918-19.

Fertilizer.	Weight.		Value.	
	Year 1919-20.	Year 1918-19.	Year 1919-20.	Year 1918-19.
	Tons.	Tons.	£	£
Bonedust	6,272	3,468	66,412	31,054
Bone char	825	200	4,889	1,149
Bone and blood	288	79	3,897	1,175
Basic slag	2,759	..	15,852	..
Egyptian basic phosphate	15,000	..	77,000	..
Superphosphate	15,842	21,400	88,120	114,999
Guano and rock phosphate	38,861	31,351	90,812	61,240
Potash	65	30	2,054	1,028
Gypsum .. .. .	..	342	2	828
Sulphate of ammonia	67	10	1,869	349
Nitrate of soda	135	204	3,816	3,435
Sulphate of iron	8	64	109	826
Manures unspecified	711	202	3,859	1,668
Totals	80,833	57,350	358,691	217,751

NOTE.—With regard to the "declared values" given above, the Comptroller of Customs supplies the following explanation: "The value for duty is defined as the fair market value in the country whence the goods are imported, plus 10 per cent. As the addition of 10 per cent. does not nearly cover the present freight, insurance, and other charges, the statistical value is a long way less than the actual landed value."

DECLARED IMPORT VALUES PER TON. OF CHIEF PHOSPHATIC AND SOLUBLE NITROGENOUS FERTILIZERS FOR 1919-20 AND 1918-19.

	Year ended 31st March, 1920.			Year ended 31st March, 1919.		
	£	s.	d.	£	s.	d.
Bonedust	10	12	0	9	0	0
Basic slag	5	15	0	Nil.		
Egyptian phosphate	5	2	8	"		
Superphosphate	5	11	0	5	7	6
Guano and rock phosphate	2	7	0	1	19	0
Nitrate of soda	28	5	0	16	17	0
Sulphate of ammonia	27	18	0	34	18	0

IMPORTS OF THE PRINCIPAL PHOSPHATIC FERTILIZERS FROM 1911 TO 1920.

Year ended 31st March.	Bonedust.	Basic Slag.	Superphosphate.	Guano and Rock Phosphate.	Ephos.
PRE-WAR IMPORTS.					
	Tons.	Tons.	Tons.	Tons.	Tons.
1911	11,058	8,670	27,442	15,963	Nil.
1912	10,799	16,227	32,567	22,050	"
1913	9,281	20,133	32,964	25,033	"
1914	6,578	30,350	41,582	22,093	"
WAR AND POST-WAR IMPORTS.					
1915	7,966	29,385	54,190	23,983	Nil.
1916	10,059	10,339	58,013	39,366	2,026
1917	10,386	6,660	31,962	24,993	8,614
1918	6,363	10	37,157	37,037	11,225
1919	3,468	Nil	21,400	31,351	Nil.
1920	6,272	2,759	15,842	38,861	15,000

IMPORTATION (IN TONS) OF PRINCIPAL ARTIFICIAL FERTILIZERS FOR YEAR ENDED 31ST MARCH, 1920, SHOWING COUNTRIES OF DEPARTURE AND NEW ZEALAND PORTS OF ENTRY.

New Zealand Port of Entry.	Australia.				Chile.		India.	Japan.	Pacific and Indian Ocean Islands.	United Kingdom.						United States.	Egypt.		
	Nitrogenous Manures.	Bonedust and Blood-and-bone.	Superphosphate.	Rock Phosphate and Phosphate unspecified.	Other Manures.	Nitrogenous Manures.	Potash Manures.	Superphosphate.	Name of Islands.	Rock Phosphate.	Nitrogenous Manures.	Superphosphate.	Gypsum.	Other Manures.	Basic Slag.	Iron Sulphate.	Nitrate of Soda.	Iron Sulphate.	Basic Phosphate.
Auckland ..	68	2,979	2,641	471	811	..	30	1,758	..	Makatea Island .. New Caledonia .. { Gilbert and Ellice Islands..	16,060 1,515 3,300	..	..	211,650	..	..	..	..	9,270
Kaipara ..	..	90	..	..	..	..	..	..	..	New Caledonia ..	1,500	..	..	..	950	..	..	..	..
New Plymouth ..	..	140	845	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wanganui ..	..	..	810	..	..	..	..	..	..	..	..	..	..	102	..	..	..	..	..
Wellington ..	70	747	5,007	1,778	..	..	..	350	..	..	..	..	..	..	..	..	..	..	5,730
Lyttelton ..	8	..	2,188	1,027	10	..	..	..	..	New Caledonia ..	270	..	..	..	..	..	..	..	..
Timaru ..	..	..	1,000	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Oamaru ..	..	..	375	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dunedin ..	20	202	823	..	25	..	..	..	..	{ Makatea Island .. New Caledonia ..	4,147 1,600	..	..	..	..	..	7	..	..
Invercargill ..	36	339	1,818	..	350	..	..	275	..	{ Makatea Island .. New Caledonia ..	6,064 1,536	..	..	..	..	..	..	..	..

NOTE.—For the previous year's corresponding statistics see *Journal* of June, 1919, page 359.

MEADOW TOP-DRESSING TEST AT MARTON.

C. H. SCHWASS, Fields Instructor, Wanganui.

IN 1917 the Department commenced an experiment on the property of Messrs. Deighton and Purnell, Marton Junction, for the purpose of ascertaining the respective values of certain top-dressings on the typical heavy land of the Marton district. An area of 6 acres of meadow was divided into six plots of 1 acre each, and the plots were top-dressed on 20th October as follows:—

Plot 1: Control—no manure.

Plot 2: Carbonate of lime, 1 ton.

Plot 3: Carbonate of lime, 1 ton; superphosphate, 3 cwt.; sulphate of potash, $\frac{1}{2}$ cwt.; blood, $\frac{1}{2}$ cwt.

Plot 4: Carbonate of lime, 1 ton; superphosphate, 3 cwt.; sulphate of potash, $\frac{1}{2}$ cwt.

Plot 5: Carbonate of lime, 1 ton; superphosphate, 3 cwt.

Plot 6: Papa rock, 2 tons.

The whole area has been closed up for hay in each of the three seasons since being top-dressed. The accompanying table gives the period for which the field was closed up each year; the weight per acre of green material cut each year; the total weight per acre of green material cut for the three seasons; the value of the hay for the three years; the cost per acre of the manure applied; and the increased return for the hay in each case over the "no manure" or control plot.

It will be seen that all the areas treated produced more feed and revenue than the untreated area, especially in the case of those plots treated with a fairly complete manure—namely, Nos. 3, 4, and 5. In addition to increased quantity of hay it is reasonable to assume that during the period the area was open to grazing each year the top-dressed plots produced proportional increases in herbage. It is known from general experience that the material produced on top-dressed areas has a higher nutritive value than that on untreated land, but no steps were taken to actually prove this in the present case. What was apparent, however, was that during the autumn, winter, and spring months of each year, when the whole of the area was grazed with sheep and horses (which stock had the run of all the plots simultaneously), they showed a preference for plots 3, 4, and 5, in the order mentioned. These plots were always eaten more closely than the others. They also showed a much closer sward, and clovers were more prominent. The areas top-dressed with lime and papa respectively displayed a greener appearance than the "no-manure" area, and also produced slightly more clovers. The pasture on the no-manure plot remained coarse, and there were hardly any clovers showing, this having been the condition of the whole of the field at the time the top-dressings were applied.

MEADOW TOP-DRESSING TEST AT MARTON JUNCTION, 1917-19.

Plot No.	Season.	Date closed.	Date cut.	Weight of Green Material per Acre.	Total Weight for Three Years per Acre.	Value of Hay for Three Years at £4 per Ton.*	Increased Return for Three Years over "No Manure" Plot.	Cost of Manures per Acre.†	Net Increased Return for Three Years.
I	1917-18	24/10/17	20/12/17	Tons. 3.65	Tons. 11.60	£ s. d. 15 8 10	£ s. d. ..	£ s. d. ..	£ s. d. ..
I	1918-19	16/10/18	6/1/19	2.89					
I	1919-20	16/10/19	22/12/19	5.06					
2	1917-18	24/10/17	20/12/17	4.28	Tons. 14.48	£ s. d. 19 6 5	£ s. d. 3 17 7	£ s. d. 1 0 0	£ s. d. 2 17 7
2	1918-19	16/10/18	6/1/19	4.18					
2	1919-20	16/10/19	22/12/19	6.02					
3	1917-18	24/10/17	20/12/17	5.90	Tons. 19.87	£ s. d. 26 9 7	£ s. d. 11 0 9	£ s. d. 2 17 0	£ s. d. 8 3 9
3	1918-19	16/10/18	6/1/19	6.26					
3	1919-20	16/10/19	22/12/19	7.71					
4	1917-18	24/10/17	20/12/17	5.70	Tons. 18.50	£ s. d. 24 12 10	£ s. d. 9 4 0	£ s. d. 2 11 0	£ s. d. 6 13 0
4	1918-19	16/10/18	6/1/19	5.94					
4	1919-20	16/10/19	22/12/19	6.86					
5	1917-18	24/10/17	20/12/17	5.22	Tons. 16.38	£ s. d. 21 16 10	£ s. d. 6 8 0	£ s. d. 2 1 0	£ s. d. 4 7 0
5	1918-19	16/10/18	6/1/19	5.14					
5	1919-20	16/10/19	22/12/19	6.02					
6	1917-18	24/10/17	20/12/17	4.55	Tons. 13.30	£ s. d. 17 14 5	£ s. d. 2 5 7	£ s. d. 2 0 0	£ s. d. 0 5 7
6	1918-19	16/10/18	6/1/19	3.85					
6	1919-20	16/10/19	22/12/19	4.90					

* Two-thirds weight of green material is allowed in each case for shrinkage.

† The price per ton of the various manures used was—Superphosphate, £7; sulphate of potash, £20; blood, £12; carbonate of lime, £1; papa, £1.

History of Field.—Following are some details of the history of the field prior to the commencement of the test here dealt with: Before 1909 the field was for several years cropped with oats. About 1909 it was sown down with the usual grass-mixture used in the district, except that more than the average amount of clover was included. No manure was sown with the grass-mixture. During the five years 1912 to 1916 the paddock was used for horses and cows, with a few sheep for killers. The whole field was top-dressed in 1913 with basic slag, bonedust, and Gear grass-manure, at the rate of 1½ cwt. to 2 cwt. per acre.

COST OF FEEDING PULLETS TO SIX MONTHS OLD.

TRIAL AT MILTON POULTRY-STATION.

F. C. BROWN, Chief Poultry Instructor.

DURING the past season a trial was conducted at the Milton Poultry-station to ascertain the cost of feeding pullets to the age of six months. Sixty White Leghorn chickens were placed in brooder. Of these, seven died when a few days old, and of the remainder twenty-nine proved to be pullets and twenty-four cockerels. The cockerels were separated from the pullets when they had attained a weight of about $3\frac{1}{2}$ lb., and the available market price for these—4s. each—was credited to the pullets, while the whole cost of feeding was charged against the pullets.

The following are particulars and actual cost of the food supplied to the chickens during the six-months period of the test:—

	£	s.	d.	£	s.	d.
Whole wheat, 1,008 lb., at 6s. 8d. per bushel				5	12	0
Cracked wheat, 187 lb., at 6s. 8d. per bushel	1	0	9			
Add cost of cracking	..	0	1	6		
				1	2	3
Crushed wheat, 112 lb., at 6s. 8d. per bushel	0	12	5			
Add cost of crushing	..	0	0	9		
				0	13	2
Pollard, 769 lb., at £9 5s. per ton ..	..			3	11	2
Bran, 254 lb., at £7 5s. per ton ..	..			0	18	5
Oatmeal, 26 lb., at 6s. 9d. per 25 lb. bag ..	..			0	7	0
Hulled oats, 264 lb., at 4s. per bushel	..	1	6	5		
Add cost of hulling	..	0	6	7		
				1	13	0
Rolled oats, 45 lb., at 35s. per 100 lb. ..	..			0	15	9
Meat-meal, 21½ lb., at 20s. per 100 lb. ..	..			0	4	4
Total				14	17	1
Deduct price realized for twenty-four cockerels sold at 4s. each				4	16	0
Net total cost				<u>£10</u>	<u>1</u>	<u>1</u>

Dividing this sum by 29 (the number of the pullets reared), the average net cost of food for one pullet works out at 6s. 11½d.

During the six months eggs to the value of £1 8s. 6d. were laid, but no credit is allowed for this amount, it having no bearing on the object of the trial.

NOTE.—The above-recorded experiment was carried out at the request of the New Zealand Poultry Association.

WOOLLY-APHIS CONTROL.

EXPERIMENTS AT ARATAKI.

T. E. RODDA, Manager, Arataki Horticultural Station.

DORMANT AND BUD-DEVELOPMENT PERIODS.

AN experiment to ascertain the best means of controlling woolly aphis by applying oils and other compounds during the dormant and bud-development periods was carried out at Arataki during the past spraying season. Twelve plots of fifteen trees were selected and treated as follows :—

No. of Plot.			Treatment.	Period applied.	Date applied.
1	..	..	Red oil, 1-6	Dormant	5 Aug.
2	..	..	Red oil, 1-8	Dormant	5 Aug.
3	..	..	Red oil, 1-10	Dormant	4 Aug.
4	..	..	Red oil, 1-10	Bud-movement	22 Aug. to 9 Sept.
5	..	..	Red oil, 1-10	Tight-cluster	9 Sept. to 3 Oct.
6	..	..	Red oil, 1-15	Tight-cluster	9 Sept. to 3 Oct.
7	..	..	Red oil, 1-30	Expanded-cluster	16 Sept. to 3 Oct.
8	..	..	Red oil 1-10, heated to 120° (sprayed)	Dormant	12 Aug.
9	..	..	Red oil 1-1, heated to 120° (painted)	Dormant	12 Aug.
10	..	..	Red oil 1-1, cold (painted)	Dormant	2 Aug.
11	..	..	Pomsol, 1-1 (painted)	Dormant	2 Aug.
12	..	..	Crude vaseline (painted)	Dormant	2 Aug.

Plots 1 to 7 were examined for results on 8th November and again on 23rd January. The results stated in numbers of aphis colonies observed were as follows :—

No. of Plot.			8th November.	23rd January.	Remarks.
			Colonies.	Colonies.	
1	4	74	Aphis was present on all portions of the trees in all plots.
2	..	..	10	84
3	..	..	37	237
4	..	..	18	110
5	..	..	13	91
6	..	..	223	Very numerous
7	..	..	245	Very numerous

Plots 8 to 12 were examined for results on 3rd November, 12th December, and 23rd January. The results were as follows :—

No. of Plot.	3rd November.	12th December.	23rd January.	Remarks.
	Colonies.	Colonies.	Colonies.	
8 ..	Nil	Nil	14	Mostly on young wood.
9 ..	1	20	42	Mostly on young wood.
10 ..	9	22	87	About evenly distributed.
11 ..	8	12	55	On all portions, both old knots and young wood.
12 ..	9	23	93	All on young wood and portions not painted at time of treatment. Old knots that had been well painted free.

From the observations it will be seen that the treatment on plot 8 (oil, 1-10, heated 120° and sprayed) gave the best results, while plot 9 (oil, 1-1, heated to 120° and painted) came second. The treatment by painting with crude vaseline controlled the pest very effectively on the old knots where it was applied. Infected places were the only portions painted during dormant period. The heavy sprayings of oil—i.e., 1-6 and 1-8—during dormant period proved to be more effective up to a certain period than the weaker strengths applied during bud-movement, tight-cluster, and expanded-cluster.

It may be added that the treatment applied to plot 8 gave the best red-mite control of any of the treatments applied to the sprayed trees. It did not by any means exterminate the pest, but the trees in this particular plot were more free from mite during January, although there has been a fair number of winter eggs deposited.

GROWING-PERIOD.

Another experiment was carried out during the season for control of aphid, the treatment in this case being applied during the growing-period. Six plots were treated respectively as follows :—

Plot 1 : Blackleaf 40, 1-800.

Plot 2 : Blackleaf 40, 1-800, plus 3 lb. soft-soap to 100 gallons.

Plot 3 : Blackleaf 40, 1-800, plus 5 lb. soft-soap to 100 gallons.

Plot 4 : Blackleaf 40, 1-800, plus lime-sulphur, 1-120.

Plot 5 : Pomsol, 1-40.

Plot 6 : Pomsol, 1-60.

The first spraying was done on 29th January, when there was a fair amount of aphid showing. An examination for results was made three days after spraying. The colonies in all plots that had been treated with Blackleaf 40 were killed where a direct hit had been registered and the woolly covering blown away, but small colonies that were not very conspicuous and had not received special attention were very active. In the plots treated with Pomsol the mortality among the aphides was not so great as in the plots treated with Blackleaf alone or in conjunction with soap or lime-sulphur. Wherever the colonies had received an extra heavy drenching most of the insects were killed, but all the smaller colonies that had only received a wetting at time of spraying were apparently unharmed.

A further examination was made on 23rd February. Aphis was very numerous on all trees in plot 1. It was very numerous on the new wood, and was very active on the old knots. Plots 2 and 3 were freer from aphis than plot 1, but it was still numerous. No difference could be determined between plots 2 and 3. Aphis was very numerous on both old and young wood in plot 4. The control was not so good as in plots 2 and 3, and there was very little difference, if any, from plot 1. No scorching of foliage was recorded. Aphis was very bad on both old and young wood in plots 5 and 6. There was apparently no difference in results from the two different strengths.

The trees in all the plots were again sprayed with the same preparations on 24th February. Examined three days after treatment the results were practically the same as recorded at the same period after the first spraying. Four weeks after treatment aphis was very numerous on trees in all the plots, especially those that had been treated with Pomsol, but plots 2 and 3 were better than the others.

From these results it is apparent that Blackleaf 40, applied alone or in conjunction with soap or lime-sulphur, is the most effective treatment, especially when used with soap. It is also apparent, however, that the control is very temporary. Aphis commenced to increase very rapidly the third week after treatment.

CONTROL OF SILVER-BLIGHT.

I. EXPERIMENT AT HASTINGS.

THE following report on an experiment for the control of silver-blight, conducted during the past year on mixed varieties of stone-fruit trees in the orchard of Mr. H. Paynter, St. George's Road, Hastings, is supplied by Mr. W. H. Rice, Orchard Instructor :—

The whole block was checked during February, 1919, and a detailed record taken of the condition of each tree. A selection of the orchard received in the autumn an application of lime at the rate of 1 ton to the acre. All treatments were duplicated on limed and unlimed land. The infected trees were classified according to amount of disease present, and divided into sections for treatment, in order to note the effect on the development of the disease, also the effect on the trees. An average of six trees in each lot were subjected respectively to the following treatments at bud-movement in early spring, 20/8/19, the quantities given being per tree in each case :—

1. Sulphate of ammonia, 2 lb. ; wood-ashes, 10 lb.
2. Sulphate of ammonia, 2 lb. ; wood-ashes, 10 lb. ; basic superphosphate, 2 lb.
3. Nitrate of soda, 2 lb. ; wood-ashes, 10 lb.
4. Nitrate of soda, 2 lb. ; wood-ashes, 10 lb. ; basic superphosphate, 2 1/2 lb.
5. Bonedust, 2 lb. ; wood-ashes, 10 lb.
6. Blood-and-bone, 2 lb. ; wood-ashes, 10 lb.
7. Orchard manure K.P. (B), 2 lb. ; wood-ashes, 10 lb.
8. Wood-ashes, 20 lb.

9. Bordeaux, 6-4-40, 6 gallons, applied to roots.
10. Same as 9, with sulphate of ammonia, 2 lb., in 8 gallons of water; K.P. (B), 2 lb.; wood-ashes, 10 lb.
11. Bluestone, 4 oz. to 4 gallons, applied to roots.
12. Same as 11, with sulphate of ammonia, 2 lb., in 8 gallons of water; K.P. (B), 2 lb.; wood-ashes, 10 lb.
13. Sulphate of potash, 2 lb.
14. Sulphate of potash, 2 lb., and K.P. (B), 2 lb.
15. Wood-ashes 10 lb.

With regard to treatments 9, 10, 11, and 12, the method adopted was to lay bare the roots over a circle equal to the spread of the frame of tree, and water with bordeaux or bluestone, as the case might be. In treatments 12 to 14 the roots were then lightly covered with soil, and after a few hours watered with the sulphate of ammonia dissolved in 8 gallons of water. The fertilizers and wood-ashes were mixed throughout the soil as it was being replaced.

Examination during February, 1920, showed the following results :—

Treatments 1 to 8 and 13: No improvement in condition of any tree; some decidedly worse.

Treatment 15: Silver-blight had made progress.

Treatment 9-10: Badly infected trees had gone off as though untreated. Slight infection, though general, had not assumed a bad form.

Treatments 11 and 12: Trees in better general condition than when treated; noticeably better in trees of light infection.

Acting on the appearance of the trees under treatment 11, a tree which was clean on examination in February, 1919, but had developed a light infection meanwhile, was subjected to treatment 11 during December, 1919. From an examination in February, 1920, this appears to have arrested the further development of the disease.

CONCLUSION.

Treatments 1 to 8 and 13 to 15 inclusive appear to be of no value in arresting the development of the disease, irrespective of limed or unlimed condition of the soil.

Treatments 9 and 10 (bordeaux, 6-4-40, applied to roots) appears of no value where trees are badly infected, but indicates probable value by retarding the development of a light infection. Similar conditions exist on limed and unlimed soil.

Treatments 11 and 12 (bluestone 1 oz. to 1 gallon at root) appears to be of value in retarding the development of the disease, particularly in cases of light infection. Results similar on limed and unlimed land.

Quite a number of trees recorded as clean in February, 1919, now show a light general infection. This is general on limed and unlimed area, and would suggest that lime has little or no effect in preventing the disease. Stimulative manures, while giving added vigour and tone to trees, appear to have no effect in retarding silver-blight.

It is recommended that experiments be continued next season to further determine the effect of root applications of bordeaux, 6-4-40, and bluestone, 1 oz. per gallon, using as a test basis trees which have developed infection only since 1919.

II. EXPERIMENTS AT ARATAKI.

Mr. T. E. Rodda, Manager of the Arataki Horticultural Station, furnishes the following report on experiments carried out at the station during the past season :—

The amount of the silver-blight infection was noted in the trees last autumn, and the treatments were applied during August. For the purposes of this report the different treatments will be signified by the letters "A," "B," and "C." These were as follows :—

"A" treatment : Bare the roots and water with bordeaux, 6-4-40, using at least 6 gallons, and then cover the roots.

"B" treatment : Same as "A," but after the bordeaux is applied cover the roots lightly with soil, and water a few hours later with sulphate of ammonia, 2 lb. to 8 gallons ; also apply a little mixed fertilizer and wood-ashes.

"C" treatment : Bare the roots and water with bluestone, 4 oz. to 4 gallons water.

The results of the treatments—noted in March—are as follows :—

Number of Trees.	Amount of Infection.	Treatment.	Date applied.	Results.
<i>Peaches.</i>				
			August.	
1	Bad ..	B	13	No improvement. One limb died right back into main fork since treatment.
1	Bad ..	A	13	Two limbs have died since treatment. All new foliage badly silvered. (Cut back hard previous to treatment.)
1	Bad ..	B	13	Five main limbs have died back to main forks since treatment. An abundance of young growth started from lower regions of tree. Most of new foliage silvered.
1	Bad ..	C	13	Slightly improved. Still a trace of silver.
<i>Plums.</i>				
1	Bad ..	B	27	Five main limbs have died since treatment. All foliage silvered. No improvement.
1	Bad ..	A	26	One main limb died since treatment. All foliage silvered. No improvement.
1	Slight ..	B	27	Portions of five main limbs have died since treatment. All foliage silvered. No improvement.
1	Slight ..	A	26	Infected limbs have died back. Balance of tree has made good growth. Much improved.

TREATMENT DURING GROWING-PERIOD.

As it was observed that the tree treated during August with bluestone solution was the only one showing any marked improvement it was decided to apply the treatment to several trees during the growing-period. The amount of the infection was noted and the

trees treated with the solution, the quantity being regulated according to the size of the tree.

The following gives an outline of the treatment and the results :—

Variety and Condition.	Treatment.	Quantity applied.	Date applied.	Results.
Apricot. Bad infection	C	Gallons. 6	November. 20	No improvement.
Apple. Bad infection	C	4	20	No improvement.
Nectarine. Slight infection	C	3	19	Old leaves still silvered. New leaves produced since treatment not showing silver. Improved.
Plum. Bad infection	C	6	19	Apparently no improvement. Leaves still silvered.
Peaches (2). Slight infection	C	6	19	Old foliage still badly silvered. Leaves produced since treatment free from silver. Improved.

It will be observed from the foregoing that the only trees that have shown any signs of improvement under this treatment are those that were but slightly infected previous to the application of the bluestone solution. To ascertain the full effect of the treatment it will be necessary to keep the trees under observation next spring, but present indications suggest that the experiments will be of little practical value.

A SOUTHLAND FODDER-CROP NOTE.

THE Fields Instructor, Invercargill (Mr. W. Alexander), forwards some particulars received from Messrs. Halliday Bros., of Kamahi, regarding a special fodder crop of oats, tares, and ryecorn, grown by them during the past season, under advice from the Department. The crop was originally intended for ensilage, but was subsequently allowed to ripen and harvested for cutting into chaff. "The land on which the crop was grown," says Mr. Alexander, "was originally in bush, but could on no account be called first-class land as it is understood in Southland. The crop was quite an object of interest during the growing and harvesting stages, it being in a field alongside the railway-line, and as an example of what may be done on some of our poorer lands the demonstration has been a very useful one." It may be mentioned that the class of fodder crop in question has so far been comparatively little grown by Southland farmers.

The notes supplied by Messrs. Halliday Bros. are as follows :—

"The area of 9 acres was ploughed from lea three years ago, and planted part in potatoes and part in turnips. The following season it was all in potatoes. The manure used was an ordinary potato-fertilizer at the rate of 7 cwt. per acre. While in the lea, twelve months before ploughing, the paddock had received 10 cwt. of carbonate of lime as a top-dressing.

" This past season we decided to try the mixture of oats, tares, and ryecorn for ensilage, and at the same time sow out in grass. The area was ploughed at the beginning of September, 9 in. to 10 in. deep, with a swamp-plough. It was then well cultivated, worked up, and rolled before sowing. The oats, &c., were drilled in on 5th November, at the rate of $1\frac{1}{2}$ bushels oats, $\frac{1}{2}$ bushel tares, and $\frac{3}{4}$ bushel ryecorn, with manure, 1 cwt. blood-and-bone, 1 cwt. super, and 1 cwt. carbonate of lime. After sowing, the ground was harrowed and rolled. Then in about a fortnight the grass-seed was sown behind the roller and covered in with a scrub harrow. The grass-seed mixture was 15 lb. cocksfoot, 4 lb. crested dogtail, 3 lb. while clover, 2 lb. cow-grass, 5 lb. timothy, 6 lb. perennial rye-rass, and 6 lb. Italian rye-grass. Finally a top-dressing of 2 cwt. super and 4 cwt. lime was given again with the roller.



HARVESTING THE FODDER CROP AT KAMAHI.

" The crop seemed to hang fire for a long time, and up till the New Year was no more than 12 in. to 15 in. high, but from then on it grew remarkably rapidly, the ryecorn especially reaching as high as 5 ft. by the end of January; the oats and tares were shorter respectively. A few weeks later at full growth we collected a few specimen roots of rye measuring over 6 ft. At this time we decided to let the crop ripen and cut it for chaff, instead of making ensilage. At the end of March we harvested, and it took twelve balls of twine for the 9 acres. We finished stacking on 10th April, having five good round stacks. We estimated each stack at a full 7 tons, so the yield per acre was just under 4 tons.*

" The tares grew rather patchily and were very thin in places, but on the whole showed a good sprinkling through the sheaves. The grass also was to some extent choked towards the centre of the field, but round the edges it was remarkably good, and doubtless will come away all right."

* This estimate has been realized in subsequent chaff-cutting.

WORK FOR THE COMING MONTH.

THE ORCHARD.

IN opening the New Zealand Fruitgrowers' Conference at Wellington on 26th May the Hon. W. Nosworthy, Minister of Agriculture, gave an interesting *résumé* of the fruitgrowing industry, leading up to its present position and future possibilities. The following extract from the speech indicates its trend and importance to the industry:—

“From the point of view of production fruitgrowing in New Zealand is no doubt quite a sound proposition, but, unfortunately, the matter does not end here. The proviso relative to reasonable market prices is the crux of the whole position. An industry cannot be said to have proved itself, nor can its importance to the community be fully assessed, until it has stabilized sufficiently to ensure to those engaged in it a reliable outlet and a reasonable return for the commodity produced. To my mind, however, the fruitgrowers' greatest hope still lies in the proper development of our local fresh-fruit markets, and there is every evidence that this can be done, possibly to the extent of utilizing at profitable prices the product of the whole of our existing orchards, provided a sufficiently efficient system of organization among growers and the trade generally is brought into existence. It is generally recognized that despite the heavy crops produced half of the people of this country get little or no fruit at all, while the major portion consume very much less than they would do were they able to readily procure supplies at a reasonable price. You must realize as well as I do that there must be something radically wrong with the present fruit-distribution system which allows such a state of affairs to exist; and, further, a system which demands the present high prices from the consumer whilst returning to the producer a meagre profit, and in some cases no profit at all, should not be tolerated a moment longer than necessity demands. What appears to me to be essential is a comprehensive organization scheme affecting the whole of the fruitgrowing areas of the Dominion, having for its object the ready disposal of the whole of our fruit crop at reasonable prices to the grower and consumer alike. In fact, I and my officers feel so strongly on the matter that I feel disposed to offer the services of the Department to assist you in establishing such an organization.”

The Minister's suggestion was well received by the Conference, and steps are now being taken with a view to giving effect to it.

Following the Fruitgrowers' Conference a Varieties Conference was held. Five delegates—representing the fruitgrowers, nurserymen, and the Department respectively—constituted this conference. The principal business was to review the findings of the conference held in 1916, relative to the varieties of fruit-trees recommended for planting for the different markets, and to make adjustments and recommendations in

connection therewith which time and experience may have suggested. The proceedings and recommendations will be of considerable value to fruitgrowers and the future developments of the industry, and it is proposed to deal with the subject in the next issue of the *Journal*, also to publish lists of classes and varieties of fruit-trees recommended for planting and reworking.

—J. A. Campbell, Assistant Director of the Horticulture Division.

AUCKLAND.

During July, all fruit-trees being at their most dormant stage, oil sprayings may be applied at fullest strength. Growers who are troubled with mussel, olæ, maire, or other scales, and red spider, are advised to get their oilings on at 1-12 to 1-14 for pip-fruits, and 1-17 for stone-fruits, at the earliest opportunity.

As soon as the autumn growth has hardened on citrus trees, spraying with red oil at 1-40 should be carried out for control of scale and thrip. In cases where there is any setting of autumn fruits the oil may be preceded by bordeaux, 4-4-40, in which case three to four days should be allowed to elapse between the two applications or leaf-scald will result.

Pruning of stone-fruits should be put in hand with all earnestness. The attention of pruners is directed to the necessity for the removal of all diseased wood and mummified fruits from the trees at the time of pruning, remembering always to gather and burn the same when the work is completed.

Trees which are required to be replaced in the orchard should be removed, and the sites made ready for the new trees. If such trees are removed on account of root-fungus or silver-blight a dressing of 2 lb. sulphate of iron well incorporated with the soil around where the old tree stood is recommended. The preparation of the sites for new orchards should now be well advanced.

Apples and pears held in store in sheds should be gone through from time to time and diseased fruits removed. Maintain sufficient ventilation in the stores, but prevent strong draughts.

—J. W. Collard, Orchard Instructor, Auckland.

HAWKE'S BAY.

Where the land has been properly prepared planting may be carried out. Watch for suitable soil conditions for this work; if the soil is waterlogged and does not work freely planting should not be done.

Pruning, followed by winter spraying, will be the most important work at this season of the year. When stone-fruit trees have been pruned they should be sprayed with lime-sulphur, 1-15, or oil, 1-17, for scale insects, followed by bordeaux, 8-6-40, at the burst of bud. Japanese plums should be watched, as they often develop bud-movement towards the end of July. "Pocket" or "bladder" plum may be prevented by a timely application of bordeaux, 8-6-40. This disease was very prevalent throughout the district last spring, and no doubt the spores are resting in enormous numbers. Growers should therefore be prepared. The pruning of apples and pears should be pushed on, and the trees receive the dormant-season application of oil or lime-sulphur. For insect pests oil, 1-12, or lime-sulphur, 1-15 (where no woolly aphid is present), should give satisfactory results. Red mite will have to be dealt with later as it hatches. Oil, even at 1-6, cannot be relied upon for control of mite in the egg stages.

Where trees are to be grafted suitable scion wood of last season's growth should be selected and held over by laying the scions in the ground in a semi-dry position with all but the tips covered. Trees which are to be grafted should be lopped down to some little distance above the point where the grafts are to be inserted, making a clean fresh cut at the time this operation is performed. By heading back such trees now the main work of cleaning up can be done at the one time, while in practice less bleeding takes place at the time of grafting.

Citrus: Lemon brown-rot is favoured by the constant damp conditions prevailing at this season of the year. All small branches and laterals sweeping the ground should be cut away, and the trees sprayed with bordeaux, 4-3-40. Should the disease make its appearance sprinkle from 1 lb. to 2 lb. of pulverized sulphate of iron on the soil round the trees to the extent of the branch-cover, and lightly rake in. Scale insects may be dealt with by spraying with oil, 1-30, using a penetrating spray and covering the whole of the wood as well as the affected foliage.

—W. H. Rice, Orchard Instructor, Hastings.

NELSON.

The most important work in the orchard at this season is pruning. Where much of this has to be done it is not safe to delay, and the most should be made of the fine weather. Obtain the best talent possible for the work. If learners have to be employed see they are under the close supervision of a foreman. Past experience indicates that it is well worth while cleaning the pruning-tools often, especially when working among silver-blighted or cankered trees. A piece of cotton-waste saturated with a solution of lysol or formalin is useful for this purpose. Where grafting has to be done later remember to put aside a good supply of cuttings.

Where planting will be done, complete the preparation of the land as soon as the weather will allow. Remember the prime objects are to clean the land of couch-grass and weeds, and obtain a good deep tilth. The work should be carried well up to the fences; to do this the hedges may want trimming back first. Once the trees are planted the opportunity for cleaning and deep cultivation is quickly discounted. When this preparation is completed, plant out the trees as soon as the land is sufficiently dry.

Orchard spraying is best deferred until next month.

Inspect the fruit in store at frequent intervals and give it all necessary attention; one can never be quite sure of what developments are going to take place.

A very important job just now is to make up a list of stores required for next season, and to secure them while one has the time to give the matter proper attention. To defer the matter until the last minute means a keen demand and high prices. Serious losses were incurred locally last season owing to an oversight of this fact. Until the transportation services are on a normal footing again the danger of trouble under this heading will be very great.

—W. C. Hyde, Orchard Instructor, Nelson.

MOTUEKA.

The directions given in last month's notes can be generally followed out this month, as the same class of work will be occupying the attention of the orchardist.

Pruning: Where heavy crops have been gathered and the bud-development promises another heavy crop next season it will be wise to thin out the crop by systematic disbudding. In many cases this season young trees—six and seven years old—have been noticed carrying far too heavy crops, the wood-growth being sacrificed for fruit. This practice, if continued, will seriously jeopardize the future of some promising orchards, a stunted, dwarfed appearance already making itself evident. Where these heavy crops have been borne on the poorer class of land it will be noticed that the development of fruit-buds is greater and the wood-growth less. On such trees disbudding is essential for the future welfare of the orchard. Disbudding should be carried out by reducing spurs or clusters of fruit-buds to two or three buds only. Always remove the weaker buds and leave good healthy buds to carry on. Those left should be as evenly spaced as possible. By doing this it will be found that both the vigour of the tree and the quality of the fruit will be considerably enhanced.

Closely followed, pruning becomes a wonderful nature-study. By assiduously watching the growth of the trees the student will find that the chief aim of nature is a continuation of the species by reproduction. The fruiting habit is always a sign of weakness. The weaker the tree the heavier the crop of fruit usually endowed by nature. While a tree is growing strong and healthy and reproducing itself by a succession of strong new wood growths little fruit will be borne, but immediately something happens to reduce the vigour of the tree—whether by insufficient pruning leaving more foliage and wood on the tree than the root-system can supply with nourishment, or by a system of root-pruning, or in any other way—so soon does nature set to work to reproduce itself by other means. The tree finding itself weakening, as if invested with reasoning-powers commences to reproduce itself by seed (the pips) to carry on the species. The edible portion surrounding these pips is, of course, the ultimate aim of production by the fruit-grower.

This fundamental knowledge should be one of the chief attributes of every pruner. Working with this fact in mind every endeavour should be made by judicious and systematic use of the pruning-tools to avoid either extreme, but chiefly, as the fruiting habit develops, the overproduction of fruit-buds. The majority of orchards in this district are still young—under ten years of age—and it is after carefully observing what is taking place and what may become a dangerous general practice that the foregoing words of caution are issued.

—W. T. Goodwin, Orchard Instructor, Motueka.

CANTERBURY.

As stated in my last month's notes, the pruning of stone-fruits should be well advanced and the pip-fruits commenced. It should hardly be necessary to go into details with regard to the pruning—in fact, it would take too long—but growers are advised to study their trees carefully, and, if not fully experienced in pruning, not to rush the work. A little extra time spent often means increased production another season. Any orchardists with young trees and wishing for information with regard to pruning should apply to the office of the Orchard Instructor, when full information will be given, and a visit made if necessary. When the pruning is finished clear up and burn all cuttings.

Those growers who have not attended to drainage should do so at once. It is time well spent.

There are still many orchards in the district that would be much better with shelter-belts planted round. This is the season to attend to the work. In the great majority of cases the poplar is the best tree to plant, as it does exceptionally well in Canterbury, but where the land is not suitable for the growing of poplars *Pinus insignis* is recommended. Providing the land is in good condition, planting can be carried out during the month.

—G. Stratford, Orchard Instructor, Christchurch.

OTAGO.

During July pruning will still be the main work in the orchard. During this operation growers will do well to look out for those trees that are affected by silver-blight. Cut out all affected parts and destroy at once, as the disseminating spores are bred on dying or decayed wood. All trees that have gone past redemption must now be rooted out and burnt immediately. All tools used in connection with these operations should be sterilized by swabbing with lysol or formalin. Cuts on trees should be dressed with a solution of corrosive sublimate, 1 to 1,000. Take care not to leave the mixture where children or animals can get at it, as it is poisonous, but it will not do any injury externally.

My attention has been drawn to the practice of some growers using flax-waste in lieu of wood-wool for apple-packing. This waste is sometimes very dusty, and where it is placed in direct contact with the apples makes them very dirty-looking. It is a good substitute for wood-wool, but growers are advised to place paper next to the fruit before applying the flax-waste.

August will be quite early enough to commence the oil spraying for insect pests. This subject will receive attention in the next month's notes.

—J. H. Thorp, Orchard Instructor, Dunedin.

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

THE HATCHING SEASON.

WHERE the heavier types of poultry are kept, such as Orpingtons, Plymouth Rocks, Wyandottes, &c., no time should now be lost in getting their eggs placed in the incubators or under broody hens. Early-hatched birds are invariably the more profitable. Indeed, if the chickens of these breeds are to produce during the next dear-egg season they should be hatched out by the end of August at the latest. For the ordinary poultry-keeper I would advise leaving the hatching of White Leghorns till August, but the parent birds should be mated now, in order that they may be well settled down before their eggs are required for reproduction purposes. Those who require only a small number of chickens, for renewing stock of the lighter breeds, will find in most cases that the best results will be obtained from pullets hatched towards the end of September.

The aim of the breeder should be to have his chickens growing as the days are lengthening. Usually chickens brought out during the hot

summer months are not only difficult to rear, but it is also generally found that they make poor progress when the days begin to shorten. Not only this but they frequently lay undersized eggs, and, not having the necessary vigour, are susceptible to all forms of disease. Therefore there should be no delay in making preparations to carry out hatching operations, which should not be delayed beyond the first weeks in October at the latest.

To those who use the natural mother for hatching and rearing their chicks I cannot emphasize too strongly the importance of keeping the hen quite free from vermin. It should be remembered that the most common cause of hens deserting their nests before the hatching-period is their being overrun with vermin. Before the hen is placed in the nest she should be dusted with carbolic powder, sulphur, or a good disinfectant powder, care being taken that it reaches the skin. Another important matter is to take every care to protect the hen and her young ones from accidents. Make the coop and run cat and rat proof. It will probably save much annoyance and loss later on. Further, when the chickens are hatched any board surrounding the nest should be removed, so that the chicks can get under the hen with ease. Scores of chicks are lost annually by getting out of the nest and being unable to return to it. Again, many a chicken has been drowned by jumping into a deep water-vessel. Minimize this risk by placing a brick or stone in such water-receptacles, or use shallower trays.

Many poultry-keepers will be using an incubator this season for the first time, and I would advise them not to rely entirely on theoretical knowledge. The best course is to consult a person of experience and obtain a practical demonstration as to the working of the machine. Then it would be well to test it with a few eggs before the practical work is entered upon. A simple test like this will prove most instructive, while it may save much subsequent loss and discouragement.

BREEDING-POINTS.

One breed is enough for most people to deal with if the flock is to be bred and managed to the best advantage. One breed may be studied successfully, whereas two may be studied indifferently.

Breeding from a pen of hens of various types is always a weak policy, even if they have proved to be good layers during their first year of production, as only a percentage of the progeny will be up to the desired standard. Careful selection of breeding-birds from a uniform type standpoint is essential if a heavy-laying flock is to be built up and maintained. Egg-performance alone will not achieve this end, as the best layer will not necessarily prove the best breeding-bird. In addition to breeding only from good layers the breeder should have an ideal type in his eye, and select birds conforming to this as near as possible. Even then it is not always possible to bring together birds which will nick with each other. The mating of birds demands great care on the part of the breeder, and the only way of bringing about an improvement in type is by using a female which is strong where the male is weak, or *vice versa*.

Such safe methods of eliminating weaknesses and strengthening desired characters cannot be left to nature, and, indeed, the remarkable development of all our races of domestic stock is mainly due to man's interference with nature to the extent of selecting the animals he mates to secure given ideal. For instance, if the hens are loose

in feather, one would select a male to mate with them with a tight and dense feather, rather than use a loose-feathered bird and thereby exaggerate what should be minimized. Few birds of the ideal laying and breeding type, which will have the desired influence in raising the standard, are to be found even in the best flocks in the country. Therefore the very greatest care should be taken in selecting the breeding-pens. Laying and breed type, desired size, and points indicative of constitutional vigour are the main things to aim at for the maintenance of a profitable flock. It is always a much safer policy to have too few birds in the breeding-pens than too many.

It is always advisable to select for the breeding-pen a hen of a slightly larger size than that which is usually considered the ideal weight for laying purposes alone. It should be remembered that it is easy to lose in weight of stock, but much harder to maintain the desired size without introducing coarseness into the type. As a rule the small birds will come readily enough without breeding for them. Breeding from small hens merely because they have proved heavy egg-producers is always a weak policy, but unfortunately there are too many breeders who fail to realize this fact.

Pullets should never be bred from if hens can be obtained. It is possible for a pullet to look a most desirable bird for breeding, but which would never be considered as a breeder at all after being subjected to the test of a season's laying. When pullets must be used they should be well-matured birds, hatched in the early spring of the previous year, and they should be mated with a vigorous cock bird in preference to a cockerel.

GRIT AND SHELLS.

Regarding the desirability of providing gravel-grit as well as oyster-shells, some birds certainly do well on sea-shells alone. As a preventative, however, of liver-trouble, and as a means of assisting digestion, sharp gravel-grit is always advisable, and in the case of the heavier breeds it is essential.

THE APIARY.

G. V. WESTBROOKE, Apiary Instructor.

DURING the cold winter months all manipulations of the bees should cease. At this period bees will be closely clustered in order to conserve heat, and it is not desirable to break the cluster, otherwise the bees are apt to become chilled.

As advised last month, it is necessary after wet weather to examine the mats in the hives, so as to ascertain that none are wet through leaky roofs. During cold weather extra mats should be supplied. Sacks or old wool-bales make excellent mats, but perhaps for winter old carpets are warmer. When cutting mats make sure that they do not overlap the edges of the hives, otherwise they will quickly become damp in rainy weather. It is better to cut them too small than too large.

STORES AND SUPPLY OF SUGAR.

Owing to the ample warning beekeepers have had in regard to the shortage of sugar there should be no danger of the bees dying of

starvation, for the careful apiarist would see that sufficient honey was left in the hives to ensure their safe wintering. In some districts where the season was bad and rapid increase was made it may be necessary to resort to feeding, but in any case this should have been done in the autumn. In some cases where there may be a doubt of sufficient stores in the hives beekeepers should at once procure sugar. This, as previously noted, may be procured from the New Zealand Honey-producers' Association, Stanley Street, Auckland, who have been appointed distributors by the controlling authorities. When applying, state the number of colonies that require feeding.

Beekeepers must not expect to get all white sugar, as so far the board of control has supplied only about one-third white and two-thirds light brown (No. 3 grade). This has been successfully fed in the Auckland Province during the late autumn without any ill effects, but in districts where bees do not get a cleansing flight it would perhaps be advisable to feed white sugar in urgent cases in the winter, reserving the lower grade for the early spring months.

None but registered beekeepers will be supplied with sugar. Any who have not registered their apiaries should therefore do so at once. It is compulsory for all persons owning one or more hives to register the same. Registration is free, and cards may be obtained at all the principal post-offices or any office of the Department of Agriculture. The fine for non-registration is £5.

MOVING BEES.

This is the best time of the year for moving bees from one location to another, for at this season they will be in a more or less dormant condition, and during cold weather there is but little danger of their smothering, as they are apt to do in summer. For short distances it will be found sufficient in most cases to secure the hive-body to the roof and bottom-board, and to tack some wire cloth across the entrance. Crate-staples will be found very useful for securing the hives to the cover and bottom-board. When, however, the bees are to be removed long distances too much care cannot be taken. Frames should be prevented from rocking in the hives during transit by wedging them firmly, first removing any heavy combs. Wire-cloth screens should also be used for long journeys, so as to give the bees as much ventilation as possible.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

IN all forward districts it is now time to get busy with seed-sowing, planting, and general preparations for the season's work. The time for sowing in spring varies greatly, even in places not far distant from each other. The condition of the soil is largely affected by the depth of the water-table: the farther this is from the surface the warmer the soil is likely to be in spring. Local experience enables a person to tell when it will be safe to begin sowing seeds. It does not necessarily

follow that early sowing will give early crops ; it may mean no crops at all if the soil is not in a fit state. A spell of fine weather may have made the soil fit for sowing, but the question is whether it will remain so if adverse weather supervenes. Bad drainage may render it waterlogged, growth may be stopped, and the seedlings become overgrown with weeds. These are things that should be considered ; it is useless to sow unless continuous growth is assured by a proper condition of soil.

Another thing to consider is what vegetables should be grown early. In the economy of a garden everything grown should be assigned a proper place. It is waste to have double the supply that is needed—waste both of time and of space. In a domestic garden the aim should be to provide a variety of vegetables in their proper season. No crop should occupy the ground longer than is necessary. If it does so it is at the expense of another crop, and usually at the sacrifice of quality. For instance, in a domestic garden the proper time for parsnips is during the winter months. Through the summer months there are peas, beans, &c. Parsnips sown at the end of October or early in November come into use by the end of March, and remain fit for use for at least five months—long enough for any one ; they are comparatively young and do not become overgrown. But sow in August, as some do, and either they are used in place of something more seasonable or they stand wasting space and becoming overgrown and rank in flavour. Carrots, also, for winter use should not be sown till October at the earliest. A small sowing in early spring is sufficient, the larger sowing being made as stated, when the soil is in a condition to render thin sowing safe. This makes a saving of time at a busier season, and thin sowing saves labour in thinning and weeding. Celery, which I consider every one should grow, should also be treated as a winter vegetable. There can be plenty of easily grown lettuces and radishes during summer and autumn, as well as cucumbers, not to mention fresh fruits. Celery, being more troublesome to grow, should therefore be limited to a few rows for winter use, when it is most acceptable. Seed need not be sown till the last half of September, and the plants put out early in January.

Seasonable Work.

Cabbages and cauliflowers should be planted as soon as the plants raised from seed sown at the end of March or the beginning of April are ready. This is an important crop, and should have special attention. Lettuce should be planted from a sowing made at the same time as cabbage and cauliflower. Broad beans should be sown, if not already done. Sow also cabbage, lettuce, radish, and parsley.

During the first week in July the first of the regular sowings of peas should be made. Two varieties should be sown at the same time for a commencement—a true dwarf for first use, and a second early to succeed it. If sticks can be provided for the later kind, any of the varieties of the Dwarf Defiance type, that grow from 30 in. to 36 in. high, will do ; if not, a dwarfer type, such as Sherwood or Stratagem, will be more suitable, for it is not profitable to grow tall-growing varieties if the haulm lies on the ground. Sow again two weeks after the first lot show through the ground ; the first sowing is usually rather slow to break through. All after-sowings are made at intervals of a fortnight.

Onions should be sown if conditions are suitable; the earlier the crop is grown the less is to be feared from mildew, which rarely appears till February. Bulbs started early have by that time so far completed their growth that they suffer a minimum amount of injury from the pest. The soil should be well prepared and free from roots of perennial weeds. It should be made firm by rolling or other appropriate means. After being well firmed the surface should be worked to a fine tilth. When sowing thus early sufficient seeds should be used to render some thinning necessary, as there are risks of losses that are not encountered with late sowing. Another reason for using a little extra seed is that a very thin line does not readily break through a surface that may be battered down by rain.

Autumn-sown onions may be transplanted. The soil should have the same preparation as for seeding. Planting must be very shallow; only the roots should be buried. The quickest method is to make shallow drills with a marker. The sets can be laid on their side with the roots in the drill; then draw a little soil over them with the side of the boot and tread firm; the plants assume the upright when they begin to grow. Basic slag is a good fertilizer, using 4 cwt. per acre; or a mixture of superphosphate and bonedust, using about 2 oz. of the mixture per square yard, equal to about $2\frac{1}{2}$ cwt. per acre. Give also sulphate of potash, 1 cwt. per acre, and if the soil is heavy the same amount of sulphate of ammonia. If the soil is light or medium the ammonia may be omitted and nitrate of soda given at a later period, directions for which will be given in a later issue. Wood-ashes and soot are valuable for onions. If a fair amount of these substances is available, give about 7 lb. per square rod. In such cases both potash and ammonia may be omitted.

Asparagus that has already been cut down should now have manure or fertilizers applied. In the case of beds stable manure should be given if possible. The manure should be in a somewhat fresh state; old, "fat" manure is not suitable. First, with a long-tined rake drag off all the soil that can be loosened from the bed; leave this soil in the alley by the side of the bed; then apply manure about 1 ft. deep. The soil is to remain until the end of August; the manure will then have settled down, and the soil should be placed on top of it. Where the asparagus is planted in lines on the flat a smaller dressing of manure may be given and left to be washed in by rain. Further treatment and other fertilizers will be mentioned later.

Old beds of summer rhubarb that have not been disturbed for several years may require lifting, and now is the time to do it. Lift the roots and pile them in any convenient place for a few weeks. The sign of the need of lifting is when the stools produce stalks of uneven quality, many of them too small to be acceptable. This means that parts of the crowns are worn out and should be cut out.

SMALL FRUITS.

Work outlined in last month's *Journal* should be completed as soon as possible. A few weeks' exposure to the weather after pruning is beneficial. All prunings should be cleared up and burned. The ashes may well be returned to the soil; they may not amount to much, but they will do some good, whereas if the prunings are dug in these breed fungus and create an unhealthy condition of soil. Fertilizers should

be applied in the course of the next few weeks. Most fertilizers are not available as plant-food till they have been some time in the ground, and it is important that they be available as soon as the plants begin to grow, as most of their work in fruit-production is done early in the season. Basic slag has proved to be a good fertilizer for fruit-trees and bushes; it is chiefly composed of lime and phosphates; 7 cwt. per acre is an efficient application. Failing basic slag, superphosphate and bonedust, or blood-and-bone, may be given, using about 4 cwt. per acre. If there is a deficiency of lime in the soil a dressing should be given two or three weeks before applying fertilizers of an acid type. Basic slag is non-acid. A minimum of 1 ton per acre of ground lime should be given, doubling that amount if lime has not been given for a few years.

TESTING FOR TUBERCULOSIS OF CATTLE IMPORTED INTO ARGENTINA.

REGULATIONS governing this matter were promulgated by the Government of the Argentine Republic under date 31st December, 1919, the main provisions being as follows:—

Thirty days after the publication of the present decree animals of the bovine species which are imported from overseas shall be submitted to the following rules: (a.) Quarantine for thirty days in the Quarantine Lazaret of the port of the capital (Buenos Aires) in accordance with the general and special veterinary sanitation regulations. (b.) Application of the ophthalmic reaction test for diagnosing tuberculosis. (c.) Injection of tuberculin in the second last or penultimate day of the quarantine, according to the instructions issued by the Directorate-General of Live-stock. (d.) Animals which clearly show reaction to either of the two above-mentioned tests shall be slaughtered. (e.) Positive diagnosis of reaction to the ophthalmic test is understood to mean those cases in which the animals have a well-defined accumulation of pus (reaction pus) in the inside angle of the eye. (f.) Animals in which the reaction is not sufficiently clear on which to form an opinion shall be subjected to further quarantine, which shall last for the time necessary to make such new tests as the Directorate-General of Live-stock may decide upon. (g.) The owners, or their representatives, of animals which have been slaughtered on account of showing reaction to the tuberculin test shall not be permitted to view the autopsy, but a detailed report thereon shall be drawn up in each case.

Winter Shows.—The winter show of the Ohakune A. and P. Association will be held on 14th and 15th July, at Ohakune.

Apiary Registration.—Owners of bees who have not hitherto registered may obtain registration-cards from all main post-offices as well as the principal offices of the Department of Agriculture.

Unidentified "Journal" Subscriptions.—The following amounts have been received without senders' names: Postal note No. 607551, issued at Otane, 5/5/20, 2s. 6d.; postal note No. 983102, issued at Auckland, 18/3/20, 1s. (with 9d. in stamps attached). Senders should communicate with the Publisher.

Importation of Animal-hair.—The regulations under the Stock Act gazetted on 28th February, 1918, permitting the introduction of animal-hair into New Zealand from the United Kingdom and Australia under certain conditions regarding sterilization, have been revoked by an Order in Council dated 20th May, 1920.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

RED SPIDER AND STRAWBERRY-BEDS.

J. H. NEWMAN WATT, Paremoremo :—

I should esteem it a favour if you would advise me as to the best method of exterminating or controlling red spider on strawberry-beds. This pest is destroying the plants and runners on some of the beds in this district. Burning the plants has been tried, but the spider is still in evidence on the new leaves. As the spider is mostly on the under-side of the leaf, it is almost impossible to get at it with the spray-pump. Would it be advisable to plough in the old beds and replant; and would it be safe to plant new ground contiguous to the infected area? Is the spider a menace to other plant-life?

The Horticulture Division :—

The red spider affects a very large number of plants; very few, in fact, are exempt from its attacks when conditions are favourable for the insect. It is an annual pest of fruit-trees, being most troublesome during dry summers. These insects sometimes do great damage in glasshouses, nearly all under-glass plants being liable to attack. Cucumber-plants are at times totally destroyed by them, this occurring because the nature of the foliage will not allow of efficient spraying. When greenhouse plants are supplied with a sufficient amount of root moisture, and the atmosphere is not allowed to become dry, there are no red-spider attacks. This is proof that dry conditions and a high temperature are necessary to bring about a bad attack. The atmosphere in the open cannot be controlled, and dry conditions are sure to favour the insects. In the case of fruit-trees and other plants that have fairly firm foliage, and that can be reached by a spray, control is fairly easy by the use of lime-sulphur. It appears to be practically impossible to spray strawberries in an efficient manner. The fact that they are badly attacked shows that the position or soil is unsuitable. Probably the soil is too dry, and their culture may have to be abandoned. Even if the whole of the insects and the eggs that are now on the plants were destroyed that would not secure future immunity. Thorough irrigation or heavy mulching might effect an improvement.

FEEDING MANGOLDS TO COWS.

“ WAIKATO FARMER,” Cambridge :—

Kindly inform me what amount of mangolds could be safely fed to cows on grass pastures, without hay, and whether it would be wise to feed the mangolds while the cows are on new grass. The roots are intended for the cows after calving.

The Live-stock Division :—

It is somewhat difficult to say what quantity of mangolds could be safely fed to cows on grass pastures, so much depending on the nature of the latter. On old rough feed a moderate daily allowance of mangolds would prove beneficial, whereas on ordinary grass paddocks if mangolds are fed to the cows for any length of time without hay digestive troubles are sure to follow. Moreover, if mangolds are fed to cows in the paddock all the animals do not get the same amount, some animals being greedy feeders while others scarcely touch them. As to mangolds being fed while cows are on new grass, you will probably find, under such condition, that the cows will not eat the mangolds.

INTERPOLLINATION FOR DELICIOUS APPLE-TREES.

"APPLE," Herne Bay, Auckland :—

I want to plant a block of Delicious apple-trees with the minimum number of another kind required to give cross-fertilization. What variety is recommended for this purpose, and what percentage would be required?

The Horticulture Division :—

The following varieties flower at the same time as Delicious and are suitable for planting in the Auckland District: Jonathan, Summer Golden Pippin, White Winter Pearmain, Cox's Orange Pippin, Dunn's, Gravenstein, Rome Beauty, Scarlet Pearmain, and Cleopatra. If it is intended to plant only one variety in addition to Delicious, Summer Golden Pearmain is recommended, this variety being a good grower and regular cropper. One row of the interpollinator in four is considered sufficient.

FEED FOR YOUNG HORSES.

"PACK-TRAIN," Clinton :—

Kindly inform me what is the best kind of crushed grain, beans, maize, peas, &c., to add to oaten-sheaf chaff fed to a young horse in order that he may develop his body to the greatest possible extent before he finishes growing.

The Live-stock Division :—

For feeding a young horse there is nothing much better than good oaten chaff with a few pounds of crushed oats, supplemented by $\frac{1}{4}$ lb. to $\frac{1}{2}$ lb. of treacle dissolved in water and mixed with the evening feed. A few swede turnips are also advisable. Crushed beans, maize, and peas are very good for horses in hard work, but in young horses they must be used with considerable discretion.

FRUITING OF SEEDLING LEMON-TREES.

J. D., Wanganui :—

I have several lemon-trees six years old, which were grown from seed. They are fine healthy-looking trees, but have never fruited. Are they likely to do so?

The Horticulture Division :—

Seedling trees are always a long time coming into fruit, this being the case with all fruit-trees. There is also a good deal of uncertainty as to the quality of fruit seedlings will produce. The method of raising fruit-trees from seeds has only one really practical adaptation—namely, for getting new varieties. Usually hundreds, sometimes thousands, of seedlings are rejected to one kept. Hybridists always take a bud or scion from the seedling and work it on to a stock as the quickest way to get fruit. Your lemon-trees can probably be made to fruit by checking the roots. At a distance of about 3 ft. from the bole of the tree dig a trench deep enough to sever all the roots. Each large root cut by the spade should be recut with a sharp knife. Begin each cut on the under-side of the root, and cut outward and upward so as to cut at an angle of about 45 degrees, then fill back the soil and tread it firm.

BRANDING CATTLE.

A. H. HUNT, Dairy Flat :—

Where is the best place to brand a beast (steer, &c.), and what are the best materials to use?

The Live-stock Division :—

We consider the best method of marking cattle running on securely fenced country is to earmark them, as by this means the eventual depreciation in the value of the hide due to body-branding is avoided. If it is deemed necessary to hide-brand cattle, it is best done on the neck, in order to avoid as much as

possible the damage to the hides. Cattle are usually branded on the rump, the reason being that that part offers a convenient and good surface for branding, and that the mark in that position can be readily detected. In our opinion the fire brand is still the best method of hide-branding.

HEIFERS FAILING TO GET IN CALF.

"DAIRY-FARMER," Whareora :—

Will you kindly give advice as to the treatment for two young heifers which fail to get in calf? I have tried sublimate tablets and lysol without success, washing both bull and heifers. The bull is a strong young Jersey which has got a number of cows in calf, but the two young heifers running with him keep on repeating.

The Live-stock Division :—

The treatment for young heifers failing to get in calf is somewhat difficult, as there are various reasons why an animal may fail to conceive. In your case, however, we are inclined to the opinion that you have been using the sublimate tabloids too freely, and by doing so have set up a certain irritation which is hindering instead of assisting the end in view. You are advised to keep the animals away from the bull for two or three months, at the end of which time they should be washed out with a solution of bicarbonate of soda and water—one tablespoonful of the soda to a gallon of warm water—just before being put to the bull.

DOG WITH SKIN TROUBLE.

J. C. SCOTT, Carnarvon :—

I have a young sheep-dog suffering from a skin-disease. The head and legs are covered with a mass of dry, scaly, small sores. Please advise me as to the best cure for the disease.

The Live-stock Division :—

The trouble is probably a condition not unusual in young dogs, resembling eczema, and most often produced by improper feeding. The following treatment is recommended : Wash the parts thoroughly, and dry. Apply daily a sufficient quantity of white precipitate ointment (which may be procured from any chemist), and give internally 2 drops of liquor arsenicalis in a little water two or three times daily. Wash the sores every third day.

FATTENING OF PIGS.

T. H. L., Hastings :—

Can you please inform me whether pigs fattened on lucerne, pumpkins, or mangolds are suitable for pork or bacon, or is it necessary to supplement their feed with grain? If grain is required in addition to the other feeds, what quantity should be given.

The Live-stock Division :—

Pigs that have fattened on lucerne, pumpkins, or mangolds are not suitable for pork or bacon until they have been finished off on some grain ration. It is a good method to supplement the forage crop with a 1- to 3-per-cent. ration of maize, barley, wheat, oats, or rye, according to the age and size of pigs, some months before they reach the killing size. By doing so an increased daily gain in weight is obtained, and at the same time a much better quality of flesh provided. A fortnight on a full grain ration will complete the feeding, and the pigs should then kill in a highly finished condition.

NOTE.—An answer cannot be given to inquiry by "Arees" (instruction in beekeeping) unless name and address are furnished.

SALE OF BEES FROM FIRE-BLIGHT AREA.

IN view of the fact that the Department's Tauranga and Ruakura apiaries are within the fire-blight infected area, no bees will be distributed from those stations during next season, 1920-21. No orders will therefore be taken until further notice. This decision, of course, mainly affects the sale of queen bees.

LAND FOR RETURNED SOLDIERS.

DURING the month of May an area of 131,796 acres, subdivided into 155 holdings, was thrown open by the Lands Department for selection. Of this, 93,900 acres was for discharged soldiers only, and included one pastoral run of 28,016 acres and three small grazing-runs of 4,760 acres, the balance of the land opened being suitable for mixed farming, cropping, dairying, &c.

During the month of June, 101,448 acres will be available for selection, of which 98,592 acres are for selection by discharged soldiers only. This latter includes one pastoral run of 21,200 acres and six small grazing-runs of 34,750 acres, the balance being suitable for mixed farming, dairying, &c., and being subdivided into 105 holdings.

Early in July, twenty sections, suitable for dairying, situated on the Hauraki Plains and comprising 1,775 acres, will be available for selection; also an area of 10,020 acres subdivided into fifteen holdings, situated in Pakauamanu Survey District, Auckland Land District. Selection in both cases is confined to discharged soldiers.

Large areas of Crown lands are under survey, and although at present it is not possible to fix a date for their opening they will be offered at earliest opportunity.

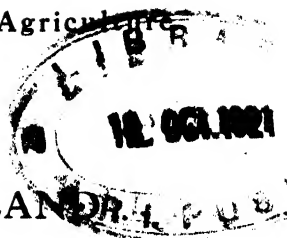
REGISTRATIONS OF FACTORIES, ETC., UNDER THE DAIRY INDUSTRY ACT, AT 30th APRIL, 1920.

District.	Creameries (Butter).	Factories (Cheese).	Private Dairies.		Packing- houses (Milled Butter).	Totals.
			Butter.	Cheese.		
Auckland ..	53	51	..	..	4	108
Taranaki ..	26	116	6	..	3	151
Wellington ..	20	70	1	..	12	103
Hawke's Bay ..	10	23	..	..	..	33
Nelson ..	7	5	..	..	6	18
Marlborough ..	4	7	..	..	..	11
Westland ..	8	4	..	..	..	12
Canterbury ..	12	16	..	..	..	28
Otago and Southland	13	92	..	..	3	108
Totals, 1920 ..	153	384	7	..	28	572
Totals, 1919 ..	159	388	18	18	29	612

NOTE.—Five dried-milk factories and one condensed-milk factory were also operating at 30th April. One dried-milk factory has started since that date.



New Zealand Department of Agriculture



THE NEW ZEALAND
JOURNAL
OF
AGRICULTURE.

VOL. XXI.

(JULY-DECEMBER, 1920.)

Published by direction of
The Hon. W. NOSWORTHY,
Minister of Agriculture.

Editor: R. H. HOOPER.

WELLINGTON.

BY AUTHORITY: MARCUS F. MARKS, GOVERNMENT PRINTER.

1920.

THE NEW ZEALAND JOURNAL OF AGRICULTURE.

VOLUME XXI.

(July - December, 1920.)

GENERAL INDEX.

A.

Abortion, syringing cows against, 98.
Agricultural bursaries, 231.
Agricultural competitions: Some Taranaki activities, 84.
Agricultural shows, forthcoming, 168, 232, 356.
Alexander, W.—
 A timothy paddock in Southland, 269.
 Gore Experimental Area: Operations in season 1919-20, 204.
Alkali soils and irrigation, 157.
Analyses of sugar-beets, 208.
Annual sheep returns, 1920, 158.
Answers to inquiries, 53, 98, 152, 217, 291, 357.
Apiary, the (monthly notes), 48, 94, 148, 214, 287, 352.
Apple-trees, oil-spraying tests on, 78.
Arsenic spraying for killing blackberry, 99.
Artificial brooding of chicks: An improved fireless brooder, 33.
Asparagus-culture, a note on, 16.
Aston, B. C.—
 Phosphates: The present position, 37.
 Soils of the Manawatu district, 57, 105.
 Improvement of poor pasture: The Wallaceville experiments, 192.
 Analyses of sugar-beets, 208.
 Testing of New - Zealand - grown wheats, 249.
 The use of Nauru Island phosphate: Efficacy of the finely ground raw material, 345.
Atkinson, E. H.— Weeds and their identification: Hemlock, 115.
Australian embargo on New Zealand potatoes, 169.

B.

Basic slag, top-dressing with, 255.
Bees, honey, and appliances, regulations for the introduction of, into New Zealand, 295.
Bees, movement of, from Auckland District, 230.
Bees, wild, transferring to hive, 99.
Beet - sugar industry: Victorian experience at Mafra, 160, 222, 293.
Blackberry, arsenic spraying for killing, 99.
Black-wattle bark for tanning: Stripping, crushing, and plantation management, 267.
Blood for fertilizer, treating, 217.
Blood in milk, heifer with, 152.
Board of Agriculture: Appointment of Mr. James Begg, 344.
Bot-fly, the horse, 291.
Bran and pollard, maximum prices of, 55.
Branding of sheep, 248.
Breaking - in of light pumice lands: Settlers' experience, 122.
Breeding, true, of plant races, 13.
Breeds and breeding for New Zealand requirements, pig, 17.
Brooder, an improved fireless, 33.
Brown, F. C.—
 Poultry - keeping (monthly notes), 47, 93, 147, 213, 286, 355.
 Artificial brooding of chicks: An improved fireless brooder, 33.
 Review: The New Zealand Utility-poultry Standards, 52.
 Development of the poultry industry, 79.
 Poultry - feeding: Meat *versus* no meat, 136.
Brown-rot on peaches, control of, 20.
Bursaries, agricultural, 231.

Butcher, W. G., and E. Earle Vaile—
Breaking-in of light pumice lands,
122.
Butter, preserving, 55.

C.

Calf-foods, 153.
Calf-rearing tests at experimental
farms, 133.
Calf, stomach trouble in, 219.
Campbell, J. A.—
The orchard (monthly notes), 44,
89, 144, 210, 283, 350.
Fruit varieties for export and local
markets: The 1920 conference,
27.
Castration and docking of lambs, 142.
Cattle, Red Poll, 253.
Cattle-tick and its control, the, 318.
Certificate-of-record testing, 42, 195,
256, 338.
Cheese, packing of, 296.
Chemical treatment of tree-stumps, 54.
Chicks, artificial brooding of, 33.
Clover, wild white, 83.
Club-root contagion, 83.
Cockayne, A. H.—
The New Zealand grass-grub: Some
notes on its control, 1.
Wild white clover, 83.
Seed-testing and control in United
States, 130.
Powdery scab in potatoes: The
Australian embargo, 169.
Cockayne, L.—
True breeding of plant races, 13.
Plant indicators: A new link be-
tween science and practice in
agriculture and forestry, 67.
An economic investigation of the
montane tussock-grassland of
New Zealand, 176, 324.
Cocksfoot-seed, Danish and New Zea-
land, 357.
Collard, J. W.—The orchard (Auck-
land District notes), 44, 89, 144,
210, 284, 351.
Competitions, agricultural, 84.
Concrete in water, laying, 323.
Control of brown-rot on peaches: The
past season's experiments at Ara-
taki, 20.
Cook Islands, tomato-culture at, 262.
Cook, J. G.—Wool-handling at shear-
ing-time: Preparing the clip for sale,
244.
Correspondence—
Alkali soils and irrigation, 157.
Eradicating wild oats on wheat
land, 221.
Cow, failure of conception in, 358.
Cow-pox, treatment for, 217.
Cow, swollen udder in, 358.
Cows, redwater in, 5.
Cows, testing of purebred dairy, 42,
195, 256, 338.

Cows, washing-out, 357.
Cracked hoofs in cow, 292.
Cultivation of root crops: An object-
lesson at Weraroa, 76.
Cunningham, G. H.—Fire-blight:
Notes for fruitgrowers, 137.
Curle, J. K.—Milking-shed drainage:
A dairy-farmer's good system, 14.
Currant-borer, the, 220.

D.

"Dairy-farming in New Zealand":
Review, 156.
Dallas, W. K.—The orchard (Canter-
bury District notes), 285, 351.
Danish and New Zealand cocksfoot-
seed, 357.
Deem, J. W.—
Field tests with Radio manure, 25.
Club-root contagion, 83.
Agricultural competitions: Some
Taranaki activities, 84.
Marton Experimental Area: Notes
on operations, 1919-20, 131.
Stratford Model Dairy Farm: Notes
on operations, 200.
Waimate West Demonstration Area:
Operations for year 1919-20, 348.
Deer and forestry, 323.
Development of the poultry industry:
Small settlement and feed-supplies,
79.
Diseases of live-stock, topical notes on
some, 189.
Disinfectants and septic tanks, 100.
Docking and castration of lambs, 142.
Dog, cattle, lameness in, 55.
Dog's tusks, shortening, 100.
Drainage, milking-shed, 14.
Dry-rot fungus of swedes, 209.
Dry-rot of swedes investigation: Pro-
gress field report, season 1919-20,
233.
Ducklings, hatching and rearing of,
213.

E.

Earmarks, transmission of, 143.
Earwigs and fruit-trees, 154.
Economic investigation of the mon-
tane tussock-grassland of New
Zealand—
VIII. An experiment in Central
Otago concerning the relative
palatability for sheep of various
pasture-plants, 176.
IX. Further details regarding the
Earnscleugh (Central Otago) pala-
tability experiment, 324.
Education, rural, 295.
Eggs for incubation, storing, 219.
Ellis, Albert F.—Nauru and Ocean
Islands: Story of the phosphate dis-
coveries and workings, 297.

Ensilage-making at Stratford Model Dairy Farm, 139.
 Eradicating wild oats on wheat land, 53, 221.
 Ewes, care of, previous to and during lambing, 74.

F.

Farmers' responsibilities when grazing stock for remuneration, 87.
 Farming in the South, pastoral, 6.
 Farm-school for farmers at Ruakura, 73.
 Fertilizers Act, the, and "Ideal Grass Manure," 104.
 Fertilizers Act, offences against the, 230.
 Fertilizers, Alsatian potash, 296.
 Fertilizers, importation of, 103, 293.
 Fertilizers, quality of artificial, 24.
 Fertilizer, treating blood for, 217.
 Field-peas for fattening lambs, 140.
 Fiji, introduction of live-stock into, 296.
 Fire-blight campaign, the, 144.
 Fire-blight: Notes for fruitgrowers, 137.
 Fire-blight, regulations for control of, 56.
 Flax (Phormium), insects inhabiting the gum fluid of, 335.
 Foot trouble in horse, 101.
 Forestry, deer and, 323.
 Forestry, private, at "Homebush," Canterbury, 271.
 Fowls, rye-corn for, 100.
 Fruit-trees, importation of, into Australia, 157.
 Fruit varieties for export and local markets: The 1920 conference, 27.

G.

Gall-aphis, leaf-stem, of the poplar, 134.
 Garden, the (monthly notes), 49, 96, 149, 215, 288, 353.
 Glasson, A. J. — Ensilage-making at Stratford Model Dairy Farm, 139.
 Goat's-rue and live-stock, 53.
 Goodwin, W. T. —
 The orchard (Motueka district notes), 46, 91, 145, 212.
 Oil-spraying tests on apple-trees, 78.
 Gore Experimental Area: Operations in season 1919-20, 204.
 Gorringe, K. W. —
 Pig breeds and breeding for New Zealand requirements, 17.
 The piggery, 126.
 Gorse, control of, 218.
 Grass-grub, clearing lawn-ground of, 218.
 Grass-grub control: Experience at Ruakura, 174.
 Grass-grub, the New Zealand, 1.

Grazing stock for remuneration, farmer's responsibilities when, 87.
 Green, A. W. — Grass-grub control: Experience at Ruakura, 174.
 Growth on mare's shoulder, 100.
 Guernsey record, a good, 151.
 Gum, scarlet flowering, propagation of the, 54.

H.

Hall, T. D. H. — Legislation of 1920 affecting rural interests, 343.
 Hedge, shelter, for Central Otago orchard, 153.
 Hemlock (*Conium maculatum* L.), 115.
 Herd-testing associations: Some results for season 1919-20, 119.
 "Homebush," Canterbury, private forestry at, 271.
 Honey, bees, and appliances, regulations for the introduction of, into New Zealand, 295.
 Honey, poisonous, 291.
 Honey, port of export for, appointed, 51.
 Hoofs, cracked, in cow, 292.
 Horse-breeding Act of Victoria, the, 294.
 Horse, foot trouble in, 101.
 Horse's foot, growth on, 154.
 Humus soils of the Manawatu district, the, 57.
 Hutchins, the late Sir David, 347.
 Hyde, W. C. —
 The orchard (Nelson district notes), 45, 91, 211, 285, 351.
 Orchard experiments in Stoke district, 81.

I.

"Ideal Grass Manure," the Fertilizers Act and, 104.
 Imperial Government wool-purchase contract, 102.
 Importation of fertilizers, 103, 293.
 Improvement of poor pasture: The Wallaceville experiments, 192.
 Indicators, plant, 67.
 Indigestion in horse, 65.
 Insects inhabiting the gum fluid of Phormium, 335.
 Invercargill prison farm, 317.
 Irrigation, alkali soils and, 157.

K.

Kea pest, the, 203.
 King, S. W. — Alkali soils and irrigation, 157.

L.

Lambing, care of ewes previous to and during, 74.
 Lambing: North Island estimate, 296.

Lambing, the season's, 360.
 Lambs, castration and docking of, 142.
 Lambs, field-peas for fattening, 140.
 Lambs, tests in winter feeding of, 203.
 Lameness in cattle-dog, 55.
 Land for returned soldiers, 51, 104, 168, 231.
 Lawn-ground, clearing, of grass-grub, 218.
 Leaf-stem gall-aphis of the poplar, 134.
 Legislation of 1920 affecting rural interests, 343.
 Levy, E. B. — Dry-rot of swedes investigation: Progress field report, season 1919-20, 233.
 Lice on sheep: A warning, 202.
 Limestones, analyses of, 40.
 Linseed-culture, 98.
 Live-stock, topical notes on some diseases of, 189.
 Loams and Otaki sands of the Manawatu district, 105.
 Lonsdale, T. W. —
 Field-peas for fattening lambs, 140.
 Tests in winter feeding of lambs, 203.
 Lucerne-meal, 75.

M.

MacDonald, the late Hon. W. D. S., 121.
 Mackenzie, F. — Sheep-management notes, 74, 142, 248.
 Maffra, the beet-sugar industry at, 160, 222, 293.
 Manawatu district, soils of the, 57, 105.
 Mangolds and pumpkins for pigs, 292.
 Marton Experimental Area: Notes on operations, 1919-20, 131.
 Maximum prices of bran and pollard, 55.
 McCulloch, W. J. — Cultivation of root crops: An object-lesson at Weraroa, 76.
 McGregor, W. J. A. — Pastoral farming in the South: A Southland calendar, 6.
 Meat *versus* no meat in poultry-feeding, 136.
 Milk for examination, samples of, 337.
 Milking-shed drainage: A dairy-farmer's good system, 14.
 Miller, D. —
 Leaf-stem gall-aphis of the poplar, 134.
 Insects inhabiting the gum fluid of Phormium, 335.
 Millton, E. B. — Sorrel in turnip crops on light land, 252.
 Montane tussock-grassland of New Zealand, an economic investigation of the, 176, 324.
 Moss-infested pastures, 219.

Inset—Ag. Jour. Index.

N.

Nauru and Ocean Islands: Story of the phosphate discoveries and workings, 297.
 Nauru Island phosphate, the use of, 345.
 New Zealand grass-grub: Some notes on its control, 1.
 Note on asparagus-culture, a, 16.
 Nurseries and plantations, State, 282.

O.

Oats and wheat, estimated areas under, 294.
 Oats and wheat threshings, 51.
 Ocean and Nauru Islands, 297.
 Oil-spraying tests on apple-trees, 78.
 Orchard experiments in Stoke district, 81.
 Orchard, the (monthly notes), 44, 89, 144, 210, 283, 350.
 Oxalis, eradicating, 153.

P.

Palatability for sheep of various pasture-plants: A Central Otago experiment, 176, 324.
 Papanui, woolly-aphis control tests at, 85.
 Park, A. D. — Farmers' responsibilities when grazing stock for remuneration, 87.
 Paspalum area, converting a, 54.
 Pasteurization in cheesemaking, 135.
 Pastoral farming in the South: A Southland calendar, 6.
 Pasture, improvement of poor, 192.
 Pasture, timothy, in Southland, 269.
 Pastures, moss-infested, 219.
 Peaches, control of brown-rot on, 20.
 Peas, field, for fattening lambs, 140.
 Phormium, insects inhabiting the gum fluid of, 335.
 Phosphate discoveries and workings at Nauru and Ocean Islands, story of the, 297.
 Phosphate, Nauru Island, the use of, 345.
 Phosphate rock, conversion of, into superphosphate, 155.
 Phosphates: The present position, 37.
 Pig breeds and breeding for New Zealand requirements, 17.
 Piggery, the, 126.
 Pigs, feeding skim-milk to, 154.
 Pigs, mangolds and pumpkins for, 292.
 Pigs, protruding rectum in, and diet, 218.
 Plantations and nurseries, State, 282.
 Plant indicators: A new link between science and practice in agriculture and forestry, 67.

Plums, bladder or pocket, 292.
 Poisoning, rabbit, 66.
 Poisonous honey, 291.
 Pollard and bran, maximum prices for, 55.
 Poplar, leaf-stem gall-aphis of the, 134.
 Potato-growing in layers, 141.
 Potatoes, powdery scab in, 169.
 Potatoes, New Zealand, the Australian embargo on, 169.
 Poultry-feeding : Meat *versus* no meat, 136.
 Poultry industry, development of the, 79.
 Poultry-keeping (monthly notes), 47, 93, 147, 213, 286, 355.
 Poultry standards, utility, 52.
 Powdery scab in potatoes : The Australian embargo, 169.
 Preserving butter, 55.
 Prison farm, Invercargill, 317.
 Private forestry : "Homebush," Canterbury, 271.
 Propagation of the scarlet flowering gum, 54.
 Pumice lands, breaking-in of light, 122.
 Pumpkins and mangolds for pigs, 292.

Q.

Quality of artificial fertilizers : Action regarding "Radio manure," 24.
 Queen-rearing, 214.
 Quince-trees, fruiting of, 54.

R.

Rabbit-poisoning, 66.
 "Radio manure," action regarding, 24.
 Rape and turnip crop, 155.
 Ratstail-grass, 101.
 Red Poll cattle : The Weraroa herd, 253.
 Redwater in cows, 5.
 Regulations for control of fire-blight, 56.
 Reid, E. A. — Tomato-culture at the Cook Islands, 262.
 Reviews and notices—
 The Dominion of New Zealand Utility-poultry Standards, 52.
 "Dairy-farming in New Zealand," 156.
 Rice, W. H. — The orchard (Hawke's Bay district notes), 45, 90, 145, 211, 284, 351.
 Rodda, T. E. — Control of brown-rot on peaches : The past season's experiments at Arataki, 20.
 Root crops, cultivation of, 76.
 Ruakura, farm-school for farmers at, 73.
 Rye-corn for fowls, 100.

S.

Sale of pedigree cattle, Weraroa, 209.
 Sands, Otaki, and loams of the Manawatu district, 105.
 Scab, powdery, in potatoes, 169.
 Scrub lands, North Canterbury, 125.
 Seed, growing turnips for, 99.
 Seed of mangolds, carrots, &c., production of, 358.
 Seed-testing and control in United States, 130.
 Seed-wheat, change of, 152.
 Septic tanks and disinfectants, 100.
 Shearing precautions and branding of sheep, 248.
 Sheep-management notes—
 Care of ewes previous to and during lambing, 74.
 Castration and docking of lambs, 142.
 Shearing precautions, and branding, 248.
 Sheep returns, annual, 1920, 158.
 Shelter hedge for Central Otago orchard, 153.
 Shepherd, J. F.—Black-wattle bark for tanning : Stripping, crushing, and plantation management, 267.
 Shows, championship, 243.
 Shows, forthcoming agricultural, 168, 232, 356.
 Silver-fish, 337.
 Simmonds, J. H. — Private forestry : "Homebush," Canterbury, 271.
 Singleton, W. M.—
 Testing of purebred dairy cows, 42, 195, 256, 338.
 Herd-testing associations : Some results for season 1919-20, 119.
 Skim-milk, feeding, to pigs, 154.
 Soils of the Manawatu district—
 The humus soils, 57.
 The loams and Otaki sands, 105.
 Soils, "tarry," 125.
 Soldiers, land for returned, 51, 104, 168, 231.
 Sorrel in turnip crops on light land : Control with sheep and lambs, 252.
 Sow, shyness of breeding in, 101.
 Spraying, oil, tests on apple-trees, 78.
 Stallion law, Victorian, 294.
 Stock slaughtered, 1919-20, return of, 168.
 Stoke district, orchard experiments in, 81.
 Stomach trouble in calf, 219.
 Stratford, G.—
 The orchard (Canterbury District notes), 46, 92, 146, 212.
 Woolly-aphis control tests at Papanui, 85.
 Stratford Model Dairy Farm, ensilage-making at, 139.
 Stratford Model Dairy Farm : Notes on operations, 200.

Stumps, tree, chemical treatment of, 54.
 Subscription, unidentified *Journal*, 104.
 Sugar-beets, analyses of, 208.
 Sugar industry, beet, at Maffra, 160, 222, 293.
 Sunflower-culture, 98.
 Superphosphate, conversion of rock phosphate into, 155.
 Swedes, cultivating, 155.
 Swedes, dry-rot fungus of, 209.
 Swedes, dry-rot investigation of, 233.

T.

Tanning, black-wattle bark for, 267.
 "Tarry" soils, 125.
 Taylor, W. H.—
 A note on asparagus-culture, 16.
 The garden (monthly notes), 49, 96, 149, 215, 288, 353.
 Testing and control of seed in United States, 130.
 Testing of dairy herds: Some results for season 1919-20, 119.
 Testing of New-Zealand-grown wheats, 249.
 Testing of purebred dairy cows, 42, 195, 256, 338.
 Tests in winter feeding of lambs, 203.
 Thorp, J. H. — The orchard (Otago District notes), 47, 92, 146, 212, 286, 352.
 Threshings of wheat and oats, 51.
 Tick, the cattle, and its control, 318.
 Timothy paddock in Southland, a, 269.
 Tomato-culture at the Cook Islands, 262.
 Tomato variety tests, 41.
 Top-dressing pasture, 220.
 Top-dressing with basic slag, 255.
 Top-dressing with lime and superphosphate, 153.
 Topical notes on some diseases of live-stock, 189.
 Transmission of earmarks, 143.
 Tree-stumps, chemical treatment of, 54.
 True breeding of plant races, 13.
 Turnip crops on light land, sorrel in, 252.
 Turnips and rape crop, 155.
 Turnips for seed, growing, 99.
 Tusks, shortening dog's, 100.
 Tussock-grassland of New Zealand, an economic investigation of the monotane, 176, 324.
 Twitch, clearing garden-land of, 221.

U.

Udder, swollen, in cow, 358.
 United States of America, exportation of live-stock from, 157.

Use of Nauru Island phosphate, the: Efficacy of the finely ground raw material, 345.
 Utility-poultry standards, 52.

V.

Vaile, E. Earle, and W. G. Butcher—
 Breaking-in of light pumice lands, 122.
 Veterinary surgeons, list of qualified, 359.
 Victoria, the Horse-breeding Act of, 294.

W.

Waimate West Demonstration Area: Operations for year 1919-20, 348.
 Wallaceville experiments in the improvement of poor pasture, 192.
 Wattle-bark for tanning, black, 267.
 Weeds and their identification: Hemlock, 115.
 Westbrooke, G. V. — The apiary (monthly notes), 48, 94, 148, 214, 287, 352.
 Wheat and oats, estimated areas under, 294.
 Wheat and oats threshings, 51.
 Wheats, testing of New-Zealand-grown, 249.
 Whitewash, 103.
 Wild oats on wheat land, eradicating, 53, 221.
 Wild white clover, 83.
 Williams, W. L. — The beet-sugar industry: Victorian experience at Maffra, 160, 222.
 Wineberry, eradicating, 155.
 Woodlice, getting rid of, 220.
 Wool, exportation of, 359.
 Wool-handling at shearing-time: Preparing the clip for sale, 244.
 Woolly-aphis control tests at Papanui, 85.
 Woolly-aphis, immunity from, 218.
 Wool-purchase contract, Imperial Government, 102.
 Work for the coming month, 44, 89, 144, 210, 283, 350.

Y.

Young, A. R.—
 Topical notes on some diseases of live-stock, 189.
 Lice on sheep: A warning, 202.
 The cattle-tick and its control, 318.

ILLUSTRATIONS.

	Page
The New Zealand grass-grub (<i>Odontria zealandica</i>)	3
Milking-shed drainage: A dairy-farmer's good system—	
Mr. Bell's milking-shed and yard at Nireaha	15
View in engine-room, showing compressor	15
Filling tank on dray from the drainage-tank	15
Quality of artificial fertilizers: Field tests with "Radio manure"—	
Field manurial trial with swedes at Stratford Model Dairy Farm ..	25
Swedes from equal areas on plots 5, 6, and 7, showing contrast in root-yield	25
Artificial brooding of chicks: An improved fireless brooder—	
The double fireless brooder	34
Details of hover	34
View showing outside runs at the Cashmere plant	35
Soils of the Manawatu district: The humus soils—	
Swampy forest on sand, Waikanae	59
Tawa and kohekohe growing on ancient dune, Waikanae	61
Looking into hollow on sand, Waikanae	61
Plant indicators: A new link between science and practice in agriculture and forestry—	
Agropyron pasture in Oregon	71
Pasture in range country, Arizona	71
Cultivation of root-crops: Part of the ridged and intercultivated swede crop at the Central Development Farm, Weraeroa	77
Soils of the Manawatu district: The loams and Otaki sands—	
View at Paekakariki, looking inland from direction of modern fixed sand-dunes	107
Area of Otaki sandstone (ancient dune) country at Shannon	107
Map of district dealt with in this series of articles	109
Weeds and their identification: Heinlock (<i>Conium maculatum</i> L.)	117
The piggery: Diagrams of movable pig-houses	129
Leaf-stem gall-aphis of the poplar—	
Galls of <i>Pemphigus populi-transversus</i> upon leaf-stems of poplar	134
Winged female of <i>Pemphigus populi-transversus</i>	135
Potato-growing in layers: The potato-growing crate in Mr. Fitzgerald's garden	141
A good Guernsey record: Leonie III of Wollongbar, a member of the Weraeroa Guernsey herd	151
Powdery scab in potatoes: The Australian embargo—	
Potatoes attacked by powdery scab (<i>Spongospora subterranea</i>)	171
Tuber attacked by ordinary potato-scab (<i>Actinomyces</i> sp.)	171
An economic investigation of the montane tussock-grassland of New Zealand: An experiment in Central Otago concerning the relative palatability for sheep of various pasture-plants—	
The small enclosure on Earnsclough area	179
Part of Earnsclough area	179
Fescue-tussock remaining uneaten at close of experiment	181
Cocksfoot and other plants shown in second figure at conclusion of experiment	181
Sheep eating yarrow in presence of lucerne, blue-grass, and tall oat-grass ..	183
Chewings fescue not eaten, but cocksfoot and lucerne eaten to ground ..	183
Cocksfoot tussocks eaten to ground	185
Tall blue-tussock eaten in the small enclosure	185

Improvement of poor pasture: The Wallaceville experiments—	Page
Graph showing weighings of sheep on experimental paddocks from May to December, 1919	193
Similar weighings from June to September, 1920	193
Testing of purebred dairy cows—	
Aster's August Child	196
Lady Superior	197
The beet-sugar industry: Victorian experience at Maffra: The Maffra beet-sugar factory	228
"Golden Swan" heifers at Ruakura	230
Dry-rot of swedes investigation: Progress field report, season 1919-20—	
Unthinned row of swedes, showing the production of closely growing, slow-maturing, disease-resistant bulbs	235
Same row as in previous figure, before removal of tops	235
Seedling-stage infection, showing top withering away through infection of bulb at crown	237
Seedling-stage infection, showing typical crown attack	237
Primary infection of well-developed bulb	237
Row marked on 1st March to note spread of disease from early-infected bulbs	239
Spread of disease from early-infected bulb	239
Showing development of the disease in patches, due to variations in soil-level	241
Showing the non-spread of the disease from an early-infected bulb, where the ground was dry and in good physical condition	241
Bulb showing primary infection at ground-level	242
Bulbs showing primary infection just below neck, with characteristic cracking of the lesion and numerous subsequent secondary infections ..	242
Testing of New-Zealand-grown wheats: The Allis Experimental Reduction Machine	251
Red Poll cattle: The Weraroa herd—	
Gold Top	254
Two first-calf heifers: Melanesia and Lucky Hit	254
Sylph	254
Tomato-culture at the Cook Islands—	
A tomato and banana plantation at Rarotonga	264
Another view of tomatoes and bananas, with manihot (tapioca) in foreground	264
Packing tomatoes for export at Rarotonga	266
Black-wattle bark for tanning: Stripping, crushing, and plantation management: Carting in wattle-bark at Te Kauwhata Horticultural Station..	269
A timothy paddock in Southland: The timothy seed-paddock and stack on Mr. Anderson's farm	270
Private forestry: "Homebush," Canterbury—	
A view at "Homebush"	273
Spruce plantation at "Homebush"	276
Some big specimens at "Homebush" (<i>Cupressus macrocarpa</i> , <i>Pinus insignis</i> , and Douglas fir)	279
Nauru and Ocean Islands: Story of the phosphate discoveries and workings—	
Key map showing geographical situation of Nauru and Ocean Islands ..	299
Map of Nauru or Pleasant Island	301
A typical phosphate-field at Nauru Island	303
Steamer loading phosphate at Nauru Island	305
Street at the phosphate settlement, Nauru, showing the unmarried-staff houses	307
Map of Ocean Island	309
Quarrying phosphate in first-class country, Ocean Island	311
Steel cantilever jetties and phosphate-bins at Ocean Island	313
Engineering-shop at Ocean Island	314
Worked-out phosphate-field at Ocean Island, showing the coral pinnacles left bare	316
The cattle-tick and its control—	
Plans of cattle-dip	320
Cattle spray-crush	321
Details of spray-crush	322
Further details of dip	322

	Page
An economic investigation of the montane tussock-grassland of New Zealand: Further details regarding the Earnscliffe (Central Otago) palatability experiment—	
Sheep eating thick dry stalks of lucerne on the experimental area ..	327
Very dry meadow-grass (<i>Poa pratensis</i>) eaten to the ground in the presence of dry cocksfoot	327
Blue-grass tussock which had been freely eaten in the presence of tall blue-tussock that had been hardly touched (the latter not shown in photo)	431
Portion of the small enclosure, showing the abundance of blue-grass and tall blue-tussock remaining after the heavy stocking to which this area was exposed	331
Insects inhabiting the gum fluid of <i>Phormium</i> —	
<i>Leptomyia decessum</i> : Larva, pupa, and adult female	336
<i>Syrphus ropalus</i> : Larva, pupa, and adult male	336
Larva of chironomid midge	337
Testing of purebred dairy cows: Alcartra Clothilde Pietje	339
The late Sir David Hutchins and Mr. J. Trounson in kauri bush, near Kaihu	347
Sixteen hundred 12-frame hive-supers manufactured by Mr. W. Lenz, Masterton, for use in his apiaries this season	360

The New Zealand Journal of Agriculture.

CONTENTS—JULY, 1920.

	PAGE
The New Zealand Grass-grub: Some Notes on its Control. <i>A. H. Cockayne</i>	1
Pastoral Farming in the South: A Southland Calendar. <i>W. J. A. McGregor</i>	6
Milking-shed Drainage: A Dairy-farmer's Good System. <i>J. R. Curle</i>	14
A Note on Asparagus. <i>W. H. Taylor</i>	16
Pig Breeds and Breeding for New Zealand Requirements. <i>K. W. Gorringe</i>	17
Control of Brown-rot on Peaches: The Past Season's Experiments at Arataki. <i>T. E. Rodda</i>	20
Quality of Artificial Fertilizers: Action regarding "Radio Manure"	24
Fruit Varieties for Export and Local Markets: The 1920 Conference. <i>J. A. Campbell</i>	27
Artificial Brooding of Chicks: An Improved Fireless Brooder. <i>F. C. Brown</i>	33
Phosphates: The Present Position. <i>B. C. Aston</i>	37
Tomato Variety Tests. <i>The Horticulture Division</i>	41
Testing of Purebred Dairy Cows: C.O.R. List for the Half-year. <i>W. M. Singleton</i>	42
Work for the Coming Month: The Orchard, <i>J. A. Campbell and Instructors</i> ; Poultry-keeping, <i>F. C. Brown</i> ; The Apiary, <i>G. V. Westbrooke</i> ; The Garden, <i>W. H. Taylor</i>	44
Land for Returned Soldiers	51
Reviews and Notices: New Zealand Utility-poultry Standards	52
Answers to Inquiries	53
Regulations for Control of Fire-blight	56
And Miscellaneous Matter.	

NOTICES.

SUBSCRIPTIONS.—The *Journal* is issued monthly. The subscription, which is payable in advance and includes postage, is 4s. per annum. Single copy, 6d. Extra copies for subscribers, 4d. Subscriptions should be forwarded by postal note to the Publisher, Department of Agriculture, Wellington. New subscribers are requested to furnish their full names and addresses, also their occupations.

CORRESPONDENCE.—Inquiries and other *Journal* correspondence on agricultural matters should be addressed to the Editor, Department of Agriculture, Wellington. Correspondence regarding *Journal* subscriptions and requests for publications generally to be addressed to the Publisher.

THE NEW ZEALAND DEPARTMENT OF AGRICULTURE.

Director-General of Agriculture : C. J. REAKES, D.V.Sc., M.R.C.V.S.

Assistant Director-General : F. S. POPE.

BRANCHES AND CHIEF FUNCTIONS:

LIVE-STOCK DIVISION.—A. R. Young, M.R.C.V.S., Director.

Investigation and treatment of diseases of animals, and advice to stockowners. Inspection of live-stock, meat, and slaughterhouses, rabbits and noxious weeds, and town-supply dairies. Instruction in poultry-keeping, swine husbandry, and wool-handling. Registration of live-stock brands.

DAIRY DIVISION.—D. Cuddie, Director.

Instruction in manufacture of butter, cheese, casein, &c. Inspection of dairy factories and factory-supply dairies. Advice regarding formation of co-operative dairy companies, and factory buildings and plant. Grading of dairy-produce for export. Supervision of herd-testing associations, and testing of purebred dairy cows. Registration of dairy factories, &c.

HORTICULTURE DIVISION.—I. W. Kirk, Director.

Instruction in production and preservation of fruit, and viticulture. Direction of Horticultural Stations. Inspection of orchards, vineyards, nurseries, and imported fruit and plants. Instruction in beekeeping; inspection of apiaries; grading of honey for export. Advice regarding orchard shelter, hedges, &c. Registration of orchards, nurseries, apiaries, &c.

FIELDS INSTRUCTION BRANCH.—(Directorship vacant.)

Advice and instruction regarding field crops and pastures. Direction of Experimental Farms and areas; co-operation with local experimental work. Field and pasture investigations.

CHEMISTRY SECTION.—B. C. Aston, F.I.C., F.N.Z.Inst., Chemist.

Analysis of soils, limestones, fertilizers, stock-foods, fodder plants, water, &c., and related advice generally. Chemical economic investigations relating to agriculture. Registration of fertilizers.

BIOLOGY SECTION.—A. H. Cockayne, Biologist.

Investigation and advice in agricultural botany, plant-pathology, entomology, &c. Identification of economic-plant specimens, insects, &c. Seed-testing.

HEMP-GRADING SERVICE.—W. H. Ferris, Chief Hemp-grader.

Grading of New Zealand hemp for export. Advice in hemp-milling.

GRAIN-GRADING SERVICE.—A. W. Smith, Chief Grain-grader.

Grading of grain, potatoes, &c., for export or coastal shipment.

PUBLICATIONS SECTION.—R. H. Hooper, Editor.

Issues the *New Zealand Journal of Agriculture*, and bulletins, reports, and other publications of the Department.

(The postal address in each case is "DEPARTMENT OF AGRICULTURE, WELLINGTON.")

The New Zealand Journal of Agriculture.

CONTENTS—AUGUST, 1920.

	PAGE
Soils of the Manawatu District: II. The Humus Soils. <i>B. C. Aston</i> ..	57
Plant Indicators: A New Link between Science and Practice in Agriculture and Forestry. <i>L. Cockayne</i>	67
Sheep-management Notes: I. Care of Ewes previous to and during Lambing. <i>F. Mackenzie</i>	74
Cultivation of Root Crops: An Object-lesson at Weraroa. <i>W. J. McCulloch</i>	76
Oil-spraying Tests on Apple-trees. <i>W. T. Goodwin</i>	78
Development of the Poultry Industry: Small Settlement and Feed-supplies. <i>F. C. Brown</i>	79
Orchard Experiments in Stoke District. <i>W. C. Hyde</i>	81
Agricultural Competitions: Some Taranaki Activities. <i>J. W. Deem</i> ..	84
Woolly-aphis Control Tests at Papanui. <i>G. Stratford</i>	85
Farmers' Responsibilities when grazing Stock for Remuneration. <i>A. D. Park</i>	87
Work for the Coming Month: The Orchard, <i>J. A. Campbell</i> and Instructors; Poultry-keeping, <i>F. C. Brown</i> ; The Apiary, <i>G. V. Westbrooke</i> ; The Garden, <i>W. H. Taylor</i>	89
Answers to Inquiries	98
Imperial Government Wool-purchase Contract	102
Importation of Fertilizers: June Quarter, 1920	103
The Fertilizer and and "Ideal Grass Manure"	104
Land for Returned Soldiers	104

And Miscellaneous Matter.

NOTICES.

SUBSCRIPTIONS.—The *Journal* is issued monthly. The subscription, which is payable in advance and includes postage, is 4s. per annum. Single copy, 6d. Extra copies for subscribers, 4d. Subscriptions should be forwarded by postal note to the Publisher, Department of Agriculture, Wellington. New subscribers are requested to furnish their full names and addresses, also their occupations.

CORRESPONDENCE.—Inquiries and other *Journal* correspondence on agricultural matters should be addressed to the Editor, Department of Agriculture, Wellington. Correspondence regarding *Journal* subscriptions and requests for publications generally to be addressed to the Publisher.

THE NEW ZEALAND DEPARTMENT OF AGRICULTURE.

Director-General of Agriculture : C. J. REAKES, D.V.Sc., M.R.C.V.S.

Assistant Director-General : F. S. POPE.

ORGANIZATION :

LIVE-STOCK DIVISION.—A. R. Young, M.R.C.V.S., Director.

Investigation and treatment of diseases of animals, and advice to stockowners. Inspection of live-stock, meat, and slaughterhouses, rabbits and noxious weeds, and town-supply dairies. Instruction in poultry-keeping, swine husbandry, and wool-handling. Registration of live-stock brands.

DAIRY DIVISION.—D. Cuddie, Director.

Instruction in manufacture of butter, cheese, casein, &c. Inspection of dairy factories and factory-supply dairies. Advice regarding formation of co-operative dairy companies, and factory buildings and plant. Grading of dairy-produce for export. Supervision of herd-testing associations, and testing of purebred dairy cows. Registration of dairy factories, &c.

HORTICULTURE DIVISION.—T. W. Kirk, Director.

Instruction in production and preservation of fruit, and viticulture. Direction of Horticultural Stations. Inspection of orchards, vineyards, nurseries, and imported fruit and plants. Instruction in beekeeping; inspection of apiaries; grading of honey for export. Advice regarding orchard shelter, hedges, &c. Registration of orchards, nurseries, apiaries, &c.

FIELDS INSTRUCTION AND EXPERIMENTAL FARMS BRANCH.—(Directorship vacant: Address Director-General.)

Advice and instruction regarding field crops and pastures. Direction of Experimental Farms and areas; co-operation with local experimental work. Field and pasture investigations.

CHEMISTRY SECTION.—B. C. Aston, F.I.C., F.N.Z.Inst., Chemist.

Analysis of soils, limestones, fertilizers, stock-foods, fodder plants, water, &c., and related advice generally. Chemical economic investigations relating to agriculture. Registration of fertilizers.

BIOLOGY SECTION.—A. H. Cockayne, Biologist.

Investigation and advice in agricultural botany, plant-pathology, entomology, &c. Identification of economic-plant specimens, insects, &c. Seed-testing.

HEMP-GRADING SERVICE.—W. H. Ferris, Chief Hemp-grader.

Grading of New Zealand hemp for export. Advice in hemp-milling.

GRAIN-GRADING SERVICE.—A. W. Smith, Chief Grain-grader.

Grading of grain, potatoes, &c., for export or coastal shipment.

PUBLICATIONS SECTION.—R. H. Hooper, Editor.

Issues the *New Zealand Journal of Agriculture*, and bulletins, reports, and other publications of the Department.

(The postal address in each case is "DEPARTMENT OF AGRICULTURE, WELLINGTON.")

The New Zealand Journal of Agriculture.

CONTENTS—SEPTEMBER, 1920.

	PAGE
Soils of the Manawatu District: III. The Loams and Otaki Sands.	
<i>B. C. Aston</i>	105
Weeds and their Identification: Hemlock. <i>E. H. Atkinson</i> ..	115
Herd-testing Associations: Some Results for Season 1919-20. <i>W. M. Singleton</i>	119
The Late Hon. W. D. S. MacDonald	121
The Breaking-in of Light Pumice Lands: Settlers' Experience. <i>W. G. Butcher and E. Earle Vaile</i>	122
The Piggery. <i>K. W. Gorringe</i>	126
Seed-testing and Control in United States. <i>A. H. Cockayne</i> ..	130
Marton Experimental Area: Notes on Operations, 1919-20. <i>J. W. Deem</i>	131
Calf-rearing Tests at Experimental Farms	133
Leaf-stem Gall-aphis of the Poplar. <i>D. Miller</i>	134
Poultry-feeding: Meat <i>versus</i> No Meat. <i>F. C. Brown</i>	136
Fire-blight: Notes for Fruitgrowers. <i>G. H. Cunningham</i> ..	137
Ensilage-making at Stratford Model Dairy Farm. <i>A. J. Glasson</i> ..	139
Field-peas for fattening Lambs. <i>T. W. Lonsdale</i>	140
Potato-growing in Layers	141
Sheep-management Notes: II. Castration and Docking of Lambs.	
<i>F. Mackenzie</i>	142
Work for the Coming Month	144
Answers to Inquiries	152
Reviews and Notices: "Dairy-farming in New Zealand" ..	156
Correspondence: Alkali Soils and Irrigation	157
Annual Sheep Returns	158
The Beet-sugar Industry: Victorian Experience at Maffra ..	160
Stock slaughtered, 1919-20. Forthcoming Shows	168
And Miscellaneous Matter.	

NOTICES.

SUBSCRIPTIONS.—The *Journal* is issued monthly. The subscription, which is payable in advance and includes postage, is 4s. per annum. Single copy, 6d. Extra copies for subscribers, 4d. Subscriptions should be forwarded by postal note to the Publisher, Department of Agriculture, Wellington. New subscribers are requested to furnish their full names and addresses, also their occupations.

CORRESPONDENCE.—Inquiries and other *Journal* correspondence on agricultural matters should be addressed to the Editor, Department of Agriculture, Wellington. Correspondence regarding *Journal* subscriptions and requests for publications generally to be addressed to the Publisher.

SALE OF PEDIGREE CATTLE, WERAROA.

ON Thursday, 7th October, 1920, at 12 noon, at the Central Development Farm, Weraroa, Messrs. Dalgety and Co. (Ltd.), will offer for sale by public auction—

**38 Friesians (5 bulls, 33 cows and heifers) ;
3 Red Poll Bulls.**

The young Friesian sires and females present a happy blending of the great-constituted and deep-milking Longbeach blood with specially selected milk-record types from the best American families.

The Red Poll dams at Weraroa have proved excellent milk-producers, and the herd is well justifying the term "dual purpose" applied to this breed.

Conveyances will meet all trains at Levin Railway-station, and take intending buyers to and from the Farm. Light luncheon provided.

**Catalogues may be obtained from the Auctioneers (Wellington),
or the Manager, Central Development Farm, Weraroa.**

THE DEPARTMENT'S EXPERIMENTAL STATIONS AND AREAS.

Ruahura Farm of Instruction, Hamilton East; railway-stations, Frankton Junction, Hamilton, or Claudelands. Dairying, stock-grazing, and general farming. Orchard; poultry section; apiary.

Central Development Farm, Weraroa; railway-station, Levin. Dairying, stock-grazing, and general farming.

Moumahaki Experimental Farm, Moumahaki; railway-stations, Moumahaki or Waverley. Dairying, stock-grazing, and general farming.

Te Kauwhata Horticultural Station, adjoining Te Kauwhata Railway-station, Lower Waikato. Fruit and vine growing; wine-making; fruit-farm settlement; black-wattle plantations, bark-mill, &c.

Avataki Horticultural Station, Havelock North; railway-station, Hastings. Fruit and vine growing, &c.

Tauranga Horticultural Station, Tauranga. Fruitgrowing (including citrus fruits). Queen-rearing apiary.

Ashburton Experimental Farm, Ashburton. General cropping—cereals, roots, fodders, &c.

The establishments are open to visitors on any day except Sundays, Good Friday, Christmas Day, and New Year's Day.

Lesser experimental areas which may be visited include the following: *Gore*, general cropping; *Winton*, general cropping; *Marion*, general cropping; *Albany* (gum lands, near Auckland), grasses, fodder plants, fruit-trees, &c.; *Puwerā* (gum lands, near Whangarei), grasses, fodder plants, pasture, &c.

The New Zealand Journal of Agriculture.

CONTENTS—OCTOBER, 1920.

	PAGE
Powdery Scab in Potatoes: The Australian Embargo. <i>A. H. Cockayne</i>	169
Grass-grub Control: Experience at Ruakura. <i>A. W. Green</i>	174
An Economic Investigation of the Montane Tussock-grassland of New Zealand: VIII. An Experiment in Central Otago concerning the Relative Palatability for Sheep of Various Pasture Plants. <i>L. Cockayne</i>	176
Topical Notes on some Diseases of Live-stock. <i>A. R. Young</i>	189
Improvement of Poor Pasture: The Wallaceville Experiments. <i>B. C. Aston</i>	192
Testing of Purebred Dairy Cows: C.O.R. Jersey List to End of September. <i>W. M. Singleton</i>	195
Stratford Model Dairy Farm: Notes on Operations. <i>J. W. Deem</i>	200
Lice on Sheep: A Warning. <i>A. R. Young</i>	202
Tests in Winter Feeding of Lambs. <i>T. W. Lonsdale</i>	203
Gore Experimental Area: Operations in Season 1919-20. <i>W. Alexander</i>	204
Analyses of Sugar-beets. <i>B. C. Aston</i>	208
Work for the Coming Month: The Orchard, <i>J. A. Campbell</i> and Instructors; Poultry-keeping, <i>F. C. Brown</i> ; The Apiary, <i>G. V. Westbrooke</i> ; The Garden, <i>W. H. Taylor</i>	210
Answers to Inquiries	217
Correspondence	221
The Sugar-beet Industry: Victorian Experience at Maffra—concluded	222
Offences against the Fertilizers Act	230
Movement of Bees from the Auckland District	230
Land for Returned Soldiers. Agricultural Bursaries	231
Forthcoming Agricultural Shows	232
And Miscellaneous Matter.	

NOTICES.

SUBSCRIPTIONS.—The *Journal* is issued monthly. The subscription, which is payable in advance and includes postage, is 4s. per annum. Single copy, 6d. Extra copies for subscribers, 4d. Subscriptions should be forwarded by postal note to the Publisher, Department of Agriculture, Wellington. New subscribers are requested to furnish their full names and addresses, also their occupations.

CORRESPONDENCE.—Inquiries and other *Journal* correspondence on agricultural matters should be addressed to the Editor, Department of Agriculture, Wellington. Correspondence regarding *Journal* subscriptions and requests for publications generally to be addressed to the Publisher.

THE NEW ZEALAND DEPARTMENT OF AGRICULTURE.

Director-General of Agriculture : C. J. REAKES, D.V.Sc., M.R.C.V.S.

Assistant Director-General : F. S. POPE.

ORGANIZATION:

LIVE-STOCK DIVISION.—A. R. Young, M.R.C.V.S., Director.

Investigation and treatment of diseases of animals, and advice to stockowners. Inspection of live-stock, meat, and slaughterhouses, rabbits and noxious weeds, and town-supply dairies. Instruction in poultry-keeping, swine husbandry, and wool-handling. Registration of live-stock brands.

DAIRY DIVISION.—D. Cuddie, Director.

Instruction in manufacture of butter, cheese, casein, &c. Inspection of dairy factories and factory-supply dairies. Advice regarding formation of co-operative dairy companies, and factory buildings and plant. Grading of dairy-produce for export. Supervision of herd-testing associations, and testing of purebred dairy cows. Registration of dairy factories, &c.

HORTICULTURE DIVISION.—T. W. Kirk, Director.

Instruction in production and preservation of fruit, and viticulture. Direction of Horticultural Stations. Inspection of orchards, vineyards, nurseries, and imported fruit and plants. Instruction in beekeeping; inspection of apiaries; grading of honey for export. Advice regarding orchard shelter, hedges, &c. Registration of orchards, nurseries, apiaries, &c.

FIELDS INSTRUCTION AND EXPERIMENTAL FARMS BRANCH.—(Directorship vacant: Address Director-General.)

Advice and instruction regarding field crops and pastures. Direction of Experimental Farms and areas; co-operation with local experimental work. Field and pasture investigations.

CHEMISTRY SECTION.—E. C. Aston, F.I.C., F.N.Z.Inst., Chemist.

Analysis of soils, limestones, fertilizers, stock-foods, fodder plants, water, &c., and related advice generally. Chemical economic investigations relating to agriculture. Registration of fertilizers.

BIOLOGY SECTION.—A. H. Cockayne, Biologist.

Investigation and advice in agricultural botany, plant-pathology, entomology, &c. Identification of economic-plant specimens, insects, &c. Seed-testing.

HEMP-GRADING SERVICE.—W. H. Ferris, Chief Hemp-grader.

Grading of New Zealand hemp for export. Advice in hemp-milling.

GRAIN-GRADING SERVICE.—A. W. Smith, Chief Grain-grader.

Grading of grain, potatoes, &c., for export or coastal shipment.

PUBLICATIONS SECTION.—R. H. Hooper, Editor.

Issues the *New Zealand Journal of Agriculture*, and bulletins, reports, and other publications of the Department.

The postal address in each case is "DEPARTMENT OF AGRICULTURE, WELLINGTON."

BRANCH OFFICES AT DISTRICT CENTRES.

The New Zealand Journal of Agriculture.

CONTENTS—NOVEMBER, 1920.

	PAGE
Dry-rot of Swedes Investigation: Progress Field Report, Season 1919-20. <i>E. B. Levy</i>	233
Wool-handling at Shearing-time: Preparing the Clip for Sale. <i>J. G. Cook</i>	244
Sheep-management Notes: III. Shearing Precautions, and Branding. <i>F. Mackenzie</i>	248
Testing of New-Zealand-grown Wheats: <i>B. C. Aston</i>	249
Sorrel in Turnip Crops: Control with Sheep and Lambs. <i>E. B. Millton</i>	252
Red Poll Cattle: The Weraroa Herd	253
Testing of Purebred Dairy Cows: C.O.R. List for October. <i>W. M. Singleton</i>	256
Tomato-culture at the Cook Islands. <i>E. A. Reid</i>	262
Black-wattle Bark for Tanning: Stripping, Crushing, and Plantation Management. <i>J. F. Shepherd</i>	267
A Timothy Paddock in Southland. <i>W. Alexander</i>	269
Private Forestry: "Homebush," Canterbury. <i>J. H. Simmonds</i> ..	271
Work for the Coming Month: The Orchard, <i>J. A. Campbell and</i> <i>Instructors</i> ; Poultry-keeping, <i>F. C. Brown</i> ; The Apiary, <i>G. V.</i> <i>Westbrooke</i> ; The Garden, <i>W. H. Taylor</i>	283
Answers to Inquiries	291
Maffra Beet-sugar Factory: Operations and Results for 1919-20 ..	293
Importation of Fertilizers: September Quarter	293
The Horse-breeding Act of Victoria	294
Estimated Areas under Wheat and Oats	294
Regulations for the Introduction of Bees, Honey, and Appliances into New Zealand	295
Rural Education	295
The Season's Lambing: North Island Estimate	296
And Miscellaneous Matter.	

NOTICES.

SUBSCRIPTIONS.—The *Journal* is issued monthly. The subscription which is payable in advance and includes postage, is 4s. per annum. Single copy, 6d. Extra copies for subscribers, 4d. Subscriptions should be forwarded by postal note to the Publisher, Department of Agriculture, Wellington. New subscribers are requested to furnish their full names and addresses, also their occupations.

CORRESPONDENCE.—Inquiries and other *Journal* correspondence on agricultural matters should be addressed to the Editor, Department of Agriculture, Wellington. Correspondence regarding *Journal* subscriptions and requests for publications generally to be addressed to the Publisher.

THE DEPARTMENT'S EXPERIMENTAL STATIONS AND AREAS.

Ruakura Farm of Instruction, Hamilton East; railway-stations, Frankton Junction, Hamilton, or Claudelands. Dairying, stock-grazing, and general farming. Orchard; poultry section; apiary.

Central Development Farm, Weraroa; railway-station, Levin. Dairying, stock-grazing, and general farming.

Moumahaki Experimental Farm, Moumahaki; railway-stations, Moumahaki or Waverley. Dairying, stock-grazing, and general farming.

Te Kauwhata Horticultural Station, adjoining Te Kauwhata Railway-station, Lower Waikato. Fruit and vine growing; wine-making; fruit-farm settlement; black-wattle plantations, bark-mill, &c.

Arataki Horticultural Station, Havelock North; railway-station, Hastings. Fruit and vine growing, &c.

Tauranga Horticultural Station, Tauranga. Fruitgrowing (including citrus fruits). Queen-rearing apiary.

Ashburton Experimental Farm, Ashburton. General cropping—cereals, roots, fodders, &c.

The establishments are open to visitors on any day except Sundays, Good Friday, Christmas Day, and New Year's Day.

Lesser experimental areas which may be visited include the following: *Gore*, general cropping; *Winton*, general cropping; *Marton*, general cropping; *Albany* (gum lands, near Auckland), grasses, fodder plants, fruit-trees, &c.; *Puwerā* (gum lands, near Whangarei), grasses, fodder plants, pasture, &c.

SUBSIDIZED DEMONSTRATION FARMS.

Stratford Model Dairy Farm, Stratford: Dairying, forage cropping, pasture-management, &c.

Waimate West Demonstration Area, near Manaia: Dairy-farming, forage-cropping, and pasture-management.

Both Farms open to Visitors.

Bound Volumes of the Journal of Agriculture.

THE Department has for sale bound half-yearly volumes of the *Journal*—from Vol. IV to Vol. XX (1912-20) inclusive.

The volumes are well bound in green cloth boards. All have a general index.

Price: 4s. 6d. per volume; or 5s., postage paid to any address. (Remittance with order.)

APPLY TO

THE PUBLISHER, DEPARTMENT OF AGRICULTURE,
WELLINGTON, N.Z.

The New Zealand Journal of Agriculture.

CONTENTS—DECEMBER, 1920.

	PAGE
Nauru and Ocean Islands: Story of the Phosphate Discoveries and Workings. <i>A. F. Ellis</i>	297
The Cattle-tick and its Control. <i>A. J. Young</i>	318
An Economic Investigation of the Montane Tussock-grassland of New Zealand: IX. Further Details regarding the Earnsclough Palatability Experiment. <i>L. Cockayne</i>	324
Insects inhabiting the Gum Fluid of Phormium. <i>D. Miller</i>	335
Samples of Milk for Examination	337
Testing of Purebred Dairy Cows: C.O.R. List for November. <i>W. M. Singleton</i>	338
Legislation of 1920 affecting Rural Interests. <i>T. D. H. Hall</i>	343
The Use of Nauru Island Phosphate: Efficacy of the Ground Raw Material. <i>B. C. Aston</i>	345
The Late Sir David Hutchins	347
Waimate West Demonstration Area: Operations for 1919-20. <i>J. W. Deem</i>	348
Work for the Coming Month: The Orchard, <i>J. A. Campbell and Instructors</i> ; The Apiary, <i>G. V. Westbrooke</i> ; The Garden, <i>W. H. Taylor</i> ; Poultry-keeping, <i>F. C. Brown</i>	350
Forthcoming Agricultural Shows	356
Answers to Inquiries	357
List of Qualified Veterinary Surgeons	359
Exportation of Wool	359
The Season's Lambing	360

And Miscellaneous Matter.

NOTICES.

SUBSCRIPTIONS.—The *Journal* is issued monthly. The subscription, which is payable in advance and includes postage, is 4s. per annum. Single copy, 6d. Extra copies for subscribers, 4d. Subscriptions should be forwarded by postal note to the Publisher, Department of Agriculture, Wellington. New subscribers are requested to furnish their full names and addresses, also their occupations.

CORRESPONDENCE.—Inquiries and other *Journal* correspondence on agricultural matters should be addressed to the Editor, Department of Agriculture, Wellington. Correspondence regarding *Journal* subscriptions and requests for publications generally to be addressed to the Publisher.

THE NEW ZEALAND DEPARTMENT OF AGRICULTURE.

ORGANIZATION:

Director-General of Agriculture: C. J. REAKES, D.V.Sc., M.R.C.V.S.

Assistant Director-General: F. S. POPE.

LIVE-STOCK DIVISION.—A. R. Young, M.R.C.V.S. Director.

Investigation and treatment of diseases of animals, and advice to stockowners. Inspection of live-stock, meat, and slaughterhouses, rabbits and noxious weeds, and town-supply dairies. Instruction in poultry-keeping, swine husbandry, and wool-handling. Registration of live-stock brands.

DAIRY DIVISION.—D. Cuddie, Director.

Instruction in manufacture of butter, cheese, casein, &c. Inspection of dairy factories and factory-supply dairies. Advice regarding formation of co-operative dairy companies, and factory buildings and plant. Grading of dairy-produce for export. Supervision of herd testing associations, and testing of purebred dairy cows. Registration of dairy factories, &c.

HORTICULTURE DIVISION.—T. W. Kirk, Director.

Instruction in production and preservation of fruit, and viticulture. Direction of Horticultural Stations. Inspection of orchards, vineyards, nurseries, and imported fruit and plants. Instruction in beekeeping; inspection of apiaries; grading of honey for export. Advice regarding orchard shelter, hedges, &c. Registration of orchards, nurseries, apiaries, &c.

FIELDS INSTRUCTION AND EXPERIMENTAL FARMS BRANCH.—(Directorship vacant: Address Director-General.)

Advice and instruction regarding field crops and pastures. Direction of Experimental Farms and areas; co-operation with local experimental work. Field and pasture investigations.

CHEMISTRY SECTION.—B. C. Aston, F.I.C., F.N.Z.Inst., Chemist.

Analysis of soils, limestones, fertilizers, stock-foods, fodder plants, water, &c., and related advice generally. Chemical economic investigations relating to agriculture. Registration of fertilizers.

BIOLOGY SECTION.—A. H. Cockayne, Biologist.

Investigation and advice in agricultural botany, plant-pathology, entomology, &c. Identification of economic-plant specimens, insects, &c. Seed-testing.

HEMP-GRADING SERVICE.—W. H. Ferris, Chief Hemp-grader.

Grading of New Zealand hemp for export. Advice in hemp-milling.

GRAIN-GRADING SERVICE.—A. W. Smith, Chief Grain-grader.

Grading of grain, potatoes, &c., for export or coastal shipment. (13)

PUBLICATIONS SECTION.—R. H. Hooper, Editor.

Issues the *New Zealand Journal of Agriculture*, and bulletins, reports, and other publications of the Department.

The postal address in each case is "DEPARTMENT OF AGRICULTURE, WELLINGTON."

BRANCH OFFICES AT DISTRICT CENTRES.



The New Zealand Journal of Agriculture.

VOL. XXI.—No. 1.

WELLINGTON, 20TH JULY, 1920.

THE NEW ZEALAND GRASS-GRUB.

SOME NOTES ON ITS CONTROL.

A. H. COCKAYNE, Biologist.

THE life-history of our ordinary grass-grub (*Odontia zealandica*) has never been really systematically worked out under controlled conditions, but sufficient is known to indicate what takes place. The eggs are laid on the surface of the ground, generally at the base of plants. In general, land that is ploughed and free from plants during the egg-laying period does not suffer from grass-grub attack the following season, but this may be due to the extra cultivations the ground receives during and after egg-laying.

Egg-laying is likely to take place during the whole period that the adult beetles are about—roughly from the end of October to the end of February. In general, however, the main egg-deposition takes place between the first week in November and the first week in December. Adult beetles have been found on the wing during most of the months of the year, but except for the great brood that emerges in November they are not of any great significance. The young grubs feed on the roots of plants, especially those of a fibrous

nature, such as those of the grasses. Many tap-rooted plants are also fed on. When the roots are young and in the seedling stage any type of plant, including forest-trees, is likely to be killed. The grubs may attain full growth before the winter and remain then in a more or less quiescent state, feeding again energetically in the early spring and pupating during October. If feed conditions have been bad the grubs may not have reached the pupating stage in October, and their emergence is thereby delayed, but in nearly every year the main brood is in a state of pupation during October. The odd emergence of beetles, during months other than what may be termed the normal ones, is due to delayed emergence and to egg-laying having occurred at varying periods of the year.

CONTROL PRACTICE.

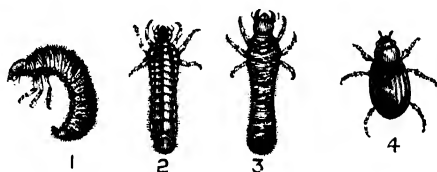
For the control of grass grub on farm land there is no practical method of destroying the pest by trapping, poisoning, burning, or by soil-fumigation and chemical treatment. Quite small areas can be dealt with by soil-fumigation with carbon bisulphide and certain insect-repellants, but such methods do not and cannot enter into farm practice. With our present knowledge, all that one can do is to avoid those practices that encourage rather than restrain the development of the beetles. The ravages of the insect are more or less periodic, which is due to two factors—an increase in the number of grubs over any particular area, and extremely dry weather conditions setting up lessened root-production. When both these factors operate at the same time the destruction caused is very great. On virtually no grassland in New Zealand is the grass-grub ever absent, but unless there is present more than a certain number to a given area—say, per square yard—the damage caused is not of any great consequence. The dryness of the soil and its fertility have, however, a great influence on the number of grubs grassland can support without the grass dying out. On rich moist soils, with an equal grub-content to inferior dry ones, often no injury may be apparent, while the grass on the poor dry soils may be completely killed. This statement may not appear sound when one thinks of the great damage caused to lawns even in a moist season and on the richest of soils, but in such cases it must be remembered that in most instances the individual root-development on lawns is poor owing to the extreme crowding of the plants.

When grass-grubs are “working” in large numbers on grassland they thoroughly pulverize and loosen the ground below the first 2 in. or so from the surface, and lessen the capillary rise of water to the soil-surface. Thus in dry weather the grasses that have been eaten through cannot rapidly form new roots, as the surface layer of soil becomes too dry. In districts of regular and abundant rainfall, however, even when the grass-roots are eaten through, new ones rapidly take their place; and unless the number of grubs is excessive very little injury results, although certain slow-rooting species may be killed out, and a distinct change in the composition of the herbage takes place.

So far as grasslands are concerned, the main damage is caused either in their first year of development—mainly in the autumn

following spring sowing—or on grassland that has been established some years, when the grasses have passed their most vigorous root-development stage. With young grass the losses are often serious, but it has been amply demonstrated that grass sown with rape often escapes damage, while grass sown with a cereal that is harvested is frequently killed out in the autumn following sowing. It is customary to explain this as due to the heavy grazing of rape crops at or about the time egg-laying takes place or when the grubs are quite small. In general, however, rape land is not stocked until well after the main egg-laying has been completed, and I am inclined to think that the ground being virtually bare at that time it is not selected by the beetle for that purpose. Investigational work on this point is much to be desired, but the fact remains that grass sown with rape in October–November generally escapes damage.

The main reasons why grass sown with cereals—more especially oats spring-sown—becomes seriously damaged in many districts is due to the readiness with which beetles lay their eggs in cereal crops, and also—and this is most important—the weak rooting and poor esta-



ODONTIRIA ZEALANDICA, ABOUT LIFE-SIZE.

1, 2, and 3, larval stages; 4, beetle. The grub is a dirty white colour, with brown head. The beetle is brown. The beetle is a night flier only, and in November and December may be observed flying with a buzzing noise just after dark. It often feeds on leaves of plants and trees, causing appreciable damage.

ishment of the grass when its full moisture-requirements have been stunted through the growing of a harvested cereal crop. So far as rotation-cropping land is concerned it would appear to be a sound practice to sow down grass only with rape, but unfortunately more grass has to be sown each year than can be provided by the rape acreage. Still, in all districts where grass-grub is usually prevalent rape or turnips should be made the last crop of the rotation rather than the first, as is often done, the grass seeded down with a cereal being in this way decreased as far as possible.

QUESTIONS OF TILLAGE AND CROPPING.

So far as older grassland is concerned, where perhaps a gradual increase in the number of grubs each year has taken place until they are more numerous than the grass can support, nothing of any practical nature can be done except reseeding or rotation cropping. Our knowledge of the effect of tillage and cultivation on the destruction of grass-grubs in the ground is very slight, and a question that is often asked is, What crop should be sown on really badly infested land? If the land in question is lea land it should, if possible, be

worked in the late spring and kept fallowed until the autumn, when it can be sown with a cereal, the later the better, as the amount of damage caused in the winter by grass-grub is small. Again, if the land is required to be cropped the same season as ploughed, any crop sown in late October should generally escape damage, and thus summer forages, linseed, and perhaps barley in the North Island should be fairly safe on land badly infested the previous autumn.

It is, however, with stubble land that the main difficulties occur, as such land may be extremely badly infested with young grubs derived from the egg-laying of the previous November. Wheat following wheat is frequently damaged by grass-grub, especially if sown early, due to infestation of the land while the first crop was on the ground. Where a cereal is to follow a cereal it should be either sown very late in the autumn or not sown until the spring. Thus winter wheat followed by spring-sown oats is generally a sound enough practice in many districts, but sowing of grass with such oats is unsound, as egg-laying occurring while the oats are standing may destroy the young grass after the oats are harvested.

I think that where oats end the annual crops of a rotation the grass-sowing should be delayed until the autumn, but it is not known just what kind of cultivation is best to precede the sowing. It is popularly supposed that heavy rolling has a great effect on grass-grub, but the effect of this operation is undoubtedly indirect and can be attributed to the ordinary effects of rolling on plant-growth, rather than to any harmful effect on the grub. In many cases rolling lawns infested with grass-grub has given quite excellent results, but in such cases the real cause of the lessened effect of the grub is in all likelihood the less interrupted water-movement from below upwards, due to the consolidation of the virtually dry mulch formed where the grubs are working. The same explanation appears to be sound also in connection with the often observed undamaged condition of young rye-grass growing in the threshing-machine wheel-marks of a paddock. Undoubtedly any practice that will promote rapid and vigorous root-development must be beneficial, and the production of a good tilth and firm seed-bed, coupled with considerable phosphatic manuring to promote root-growth, appears to be of great value in warding off the effects of grass-grub.

The effect of lime is frequently brought up in connection with grass-grub, but no exact work in this connection has been done. It has been frequently noted that grasslands on limestone soils show less grub-damage than on soils where the lime-content is low. From my observations, this is not due to the absence of grass-grub in the former, but may be accounted for by the better soil conditions for grass-growth. The idea that lime is useful in controlling grass-grub is perhaps due to the apparent effect of limewater in bringing up grubs to the surface, but this is quite a common occurrence when soils are suddenly saturated.

RESISTANT PASTURE-PLANTS.

Another question that is frequently asked is, What pasture-plants are most immune from attack? In general, clovers—especially red clover—are more resistant to attack than are the grasses, and the

same applies to many pasture weeds that have strong, long tap-roots, such as catsear, rib-grass, and the like. In many parts of Canterbury the development of catsear and rib-grass associations on old pastures is largely due to the grasses having been killed out by grass-grub. Among the grasses, cocksfoot and crested dogstail both resist attack well, especially the former, although the roots of both are freely eaten. Perennial rye-grass is especially liable to be killed, and for this reason the using of small amounts of cocksfoot—2 lb. to 4 lb. per acre—in short-rotation mixtures has become customary where grub is usually bad. The custom is generally a bad one, as when a severe attack occurs the rye-grass (by far the most dominant element sown) is killed out, and the small amount of cocksfoot that is left is not sufficient to yield much feed, but often tempts the farmer to leave the land in grass, hoping that the bare ground will fill up. In country where grass-grub is ordinarily bad grass-seed mixtures should have their rye-grass content reduced in favour of cocksfoot and crested dogstail, and where the soil is suitable the clover-content should be increased. *Danthonia pilosa* appears to withstand grass-grub attack remarkably well, and where on hill country liable to periodic infestation this grass is amongst the few permanent ones that can be established it should always be included in the mixture. Another plant that appears to withstand grub-attack to a remarkable degree is yarrow, and its great spread and persistence in old pastures in many parts of Canterbury is probably due to its almost complete immunity from grub-injury.

SMALL AREAS.

With regard to garden areas, control should always be in the direction of cultivating the ground as much as possible during the egg-laying period. On very small areas, and on small lawns where cultivation cannot be adopted, soil-fumigation with carbon bisulphide may be adopted, as already mentioned.

NOTE.—Other articles on the subject of grass-grubs by the writer have appeared in the *Journal* for September, 1911, and December, 1912.

Redwater in Cows.—In this country redwater is due to a variety of causes, which could be nearly all embraced under the conditions existing about three weeks before calving and three weeks after. Frosted feed is a common cause, and a too liberal supply of almost any root crop or green feed during this period is apt to bring on the trouble. There is no more reliable feed for cows for a week or two before and after calving than grass, supplemented with hay where necessary, or limited quantities of other feed. The cure for redwater, of course, depends upon the cause, which should be removed if possible—for instance, by change of feed. At the same time the cow should be kept dry and warm, and given a drench consisting of $\frac{1}{2}$ lb. Epsom salts, 2 lb. treacle, and $\frac{1}{2}$ oz. turpentine. An animal which gets very low may often be kept alive by drenching with oatmeal gruel and a couple of large bottles of beer per day.—*Livestock Division.*

PASTORAL FARMING IN THE SOUTH.

A SOUTHLAND CALENDAR.

W. J. A. MCGREGOR, Mount Linton, Southland.

[The following notes on the yearly routine of pastoral farming in Southland are published mainly with the object of affording some practical hints to new or inexperienced local settlers and many of the young men now taking up grazing-runs. They also form an interesting outline record of this class of farming in the southern part of New Zealand generally. It will be observed that while the branch of agriculture dealt with is primarily grazing on tussock country of more or less height, a very considerable and essential amount of cropping is practised on arable parts of the holdings for the provision of winter and other extra feed, this maintaining a good standard of farming. Mr. McGregor is a well-known Southland settler of long experience, whose property, Mount Linton, affords an excellent example of the class of country and farming described.—EDITOR.]

JANUARY.

BEGINNING with the first month of the calendar year, January finds the Southland pastoralist in mid-shearing. As a rule the dry sheep have already been shorn, and the shearing of the wet ewes is now on. This work we like completed before the middle of the month if possible—before the “biddy-biddy” (piripiri) seed gets into the wool too much. In some seasons, of course, the burrs are earlier and in some later, but it is found as a rule that after the second week of January they have matured and begin to stick badly on the wool. Cuts or mobs of the wet ewes (breeding-ewes and lambs) are carefully mustered in from their blocks of country or paddocks, and placed handy to the shed as they are wanted. The ewes are shorn and replaced with their lambs as soon after as possible on the ground they were mustered from, as the lambs mother up best in their own country. Should bad weather restrict their return, and they are detained in some sheltered spot for a day or two, the ewes fret and wander round the fences, and the lambs refuse to mother. The longer they are thus detained, especially if the weather is rough, the more tender and inflamed the ewes’ udders become, with the result that they refuse to allow the lambs to suckle. As a consequence—unless the lambs are well grown and able to fend for themselves at this stage—there may be an undue proportion of cull lambs at weaning-time. With a few favourable days the cut-out of the wet ewes arrives and the main shearing of the season is over. The “boss” superintends the clearing up, receiving the machine gear (if machines are in use), which should be cleaned up before handing in.

Meanwhile the shepherds are busy fixing up the shorn sheep, finishing branding and mouthing, and taking out all the dry ewes (if this has not been done at lamb-marking), thus lightening the country so that the wet ewes and their lambs may thrive better. It is, however, preferable to do the mouthing and culling (which are practically combined by many) in the wool before the sheep go into the shed, as sheep defective in wool are then not so readily missed. The lambs of each mob or cut of ewes have been drafted off before the

ewes go into the shed, and placed in some secure place adjacent, where they are gone through before replacing with their shorn dams. All poddy or motherless lambs should be taken out and placed in some good paddock where they will make good. Any long-tailers missed at marking-time are now operated on and marked. This is always more or less risky, and it should be done in some clean pen free from dust, and wounds dressed with an antiseptic, or turps and oil. The operation is best done towards evening, when it is cool and the lambs are empty, after which the sooner they are away from the dusty yards and the quieter they are handled back to their mothers the better. If raced about dusty yards with dogs some loss can be expected for a certainty.

Although the shearing, while it is on, has been absorbing most attention, the teams will have been quietly pushing on with the turnip-sowing, or, if the opportunity presents itself, cutting and securing some hay for the coming winter. After the main shearing is over and the shorn sheep are all placed out the next move is to muster the stragglers—"woollies" that have been missed. These are mustered in from all over the run, as well as received in exchange for other stragglers with neighbours. Meanwhile, during this muster the teams may be busy carting the wool to the nearest railway-station *en route* for sale. The back-loading of stores, coal, or other requirements is availed of as the wool is carted away. After the carting is finished turnip-sowing is completed. Then the grass-seed may be ready to cut, as it usually is towards the end of January. About the beginning of the month the bulls are put out with the breeding-cows.

FEBRUARY.

The shearing of the stragglers is usually an opportunity for some of the boys to learn the art. A day or two sees the stragglers sorted up and branded, and away out to some secure paddock or block where they are not likely to get back to their old haunts. With fine weather the grass cut for seed will now be ready for stacking, which work is carried out. The oats usually grown for supply of chaff and horse-feed will probably be ready to cut and stook.

The stud ewes and their lambs will now be brought in for weaning and dipping. The lambs after being drafted, sorted up, crutched, branded, and dipped are placed on good, clean, fresh feed—the ram lambs in one paddock and the ewe lambs away separate in another. Any culls will also have been taken out from both the stud ewes and lambs. Stud and flock rams are next sorted up. Culls that were marked as such when in the wool prior to shearing, together with any others that it now seems advisable to cull out, are drafted off and disposed of as suitable. Before dipping the rams it is well to go thoroughly through them, turning them up and trimming their feet if required, and looking out for any defects that may catch the eye. In this south-western part of the country we have endeavoured to produce rams of a good bold appearance, large of bone, square-framed, standing well set on their four legs, with a well-set strong head, and a covering of dense even-quality wool.

February is usually the driest month of the year in this district, hence every opportunity should be taken to push along harvest work.

Other work for which this month is most suitable is cutting weeds and rabbit-poisoning. Where poisoned pollard is used the baits should be dried as hard as shot, as we have found that the rabbits take them better in that condition. In laying the baits we simply drop them on the bare feeding-spots, about the warrens, and among the tussocks, and seldom do we find the sheep taking them on the native pasture. In the paddocks the sheep are more likely to do so, and have to be shifted. Other work that can also be carried out is the preparation of stack-bottoms, stacking if the crop has been cut early, and thatching hay or oat stacks.

MARCH.

About the last week of February a start will have been made with the weaning and dipping muster of the hill ewes and their lambs, and this work goes on in March. As each mob is brought in it is drafted, and the lambs divided into the keeping and sale lambs. The keeping-lambs are crutched, branded, dipped, and placed out as soon as possible on a piece of warm, clean, native grassland that has been saved throughout the summer, or perhaps in spelled paddocks. This gives them a good opportunity to forge ahead as hoggets, to get used to their ground, and be in good order to face ordinary winter conditions. A good salt-lick should be placed here and there, which will help to keep them in good health. The ewes also, after the culls have been drafted off, are dipped and placed out again. The sale ewes and lambs are dipped and placed in good separate paddocks prior to going to sale, or awaiting delivery if already sold.

Now that March is well in, no chance must be lost of getting the oats stacked, as missing any opportunity this month may mean weeks of waiting, during which the action of birds and rabbits is very detrimental to the stocks.

APRIL.

April is also a busy month with the stock. The stud rams are put out during the first week with the stud ewes, which will have been graded to suit the rams. The dry sheep are mustered in from off any high or back country, and are sorted up and dipped and placed on their winter country. The dry sheep mustered in for dipping will consist mostly of the maiden ewes (four-tooth), two-tooth ewes and wethers, and probably odd lambs. Any culls will be taken off and either sold or put on turnips, whichever may be deemed most profitable. The four-tooth maiden ewes are retained for breeding purposes, and the other dry sheep put back on their country after being dipped. Cattle should also be sorted up, calves weaned, and any cull cows disposed of. Forward steers will be sold, unless there is plenty of turnips and hay or straw to finish them off.

All carting of heavy stuff, such as coal and other necessities, should be completed this month in order to save the roads, such heavy traffic being prohibited in most counties from 1st May to 30th September.

MAY.

In the second week of May the flock rams are put out—about one to forty-five ewes on hill country. The rams should be sound, vigorous, and strong, as on hilly country they may have a good deal

of travelling to do. Six weeks is long enough for the rams to be out. During the last two weeks it is a good plan to slip out a few extra rams that have been kept in reserve, in order to quicken off the tupping. While the rams are out the ewes should be frequently turned in to save the rams missing any. While doing so the shepherd on his rounds skins any dead sheep he may drop across, or gathers up any dead wool that may have been missed. Other sheep should also be looked round frequently—the dry sheep (two-tooth ewes and wethers) on their country and the hoggets on theirs—to see that they are not hanging about too long in any places that are beginning to get bare and dirty. If good paddocks are available for holding the ewes while with the rams the chance of the ewes getting in lamb is, of course, much better, but should the paddocks be bare, then both ewes and rams are better out on the hills.

Preparations for feeding off turnips will commence about the middle of this month, unless any lamb-fattening may have been taking place, when the lambs would need to have been put on in February or early March. Most pastoral holdings simply grow enough turnips to winter store sheep or backward sheep that may be improved by so doing. Breaks not too big should be erected, otherwise turnips will be more or less wasted, and a good run-off should be provided. Hoggets should get a fresh break each week or two, to themselves if possible, letting older sheep clean up behind them. It may be found difficult to get tussock lambs or hoggets to eat turnips for a start, but persistence and coaxing for about a week is all that is required. Close them in for a few hours a day and take them off at nights until they have cultivated an appetite for the roots, when there will be no stopping them.*

During this month all sheep that are to be turniped or kept about the paddocks should be crutched. There is not the same need to do so with tussock-country sheep, and fortunately we have no fly trouble in the South. It pays to take the wool off clean. After tupping is over we simply turnip the rams. Stud ram and ewe hoggets, stud ewes (for six weeks), medium hoggets, two-tooths, and a few wethers and backward ewes we also turnip.

Once the sheep work is out of the way the weaning of calves from the breeding-cows takes place. This is usually carried out by simply placing cows on one side and calves on the other side of a sound wire fence with a good barb on it. In about a week's time they will have settled down and can be shifted. An odd calf may get through to its mother, but if put back may remain. The calves should be placed on good feed, with a bit of hay or straw to pull at, and later—say, in July or August—given some turnips. I find they winter well out on the native grassland with the hoggets, in good rough sheltered gullies.

Throughout May (and during the ensuing months until September) the team or teams will have been busy at all opportunities ploughing up

* A lick I have found these young sheep very fond of and very beneficial to their health consists as follows: 1 bag (180 lb.) salt, 50 lb. builder's lime slaked, 30 lb. superphosphate, 3 lb. to 4 lb. sulphur, and 5 lb. sulphate of iron, mixed up, then wetted and moulded into blocks, and taken out as required. This lick, however, should be used only for dry sheep and not given to breeding-ewes lest aborting occur.

stubble or lea land. The earlier the ploughing is done the more satisfactory the results, and the less working required, due to the frosts pulverizing and sweetening the soil.

JUNE.

With the coming of June the grass-paddocks will begin to get shorter. Looking after the turnip sheep and erecting breaks takes up much of the time. June is usually a fairly dry month, and it is a good plan to cut plenty of chaff, enough for well into August. The sheep work being practically finished, all that is now required is simply looking after the sheep and seeing that they are well placed to face the next two months. Yards and fences that need repairing should be attended to whenever any opportunity arises. Rabbit-poisoning may be carried out to some extent, satisfactory results depending on the weather. Cattle can also be attended to and placed in decent winter quarters. By the end of the month the rams will all have been collected and brought in and placed on the turnips.

JULY.

In July we can expect wintry weather, demanding close attention to stock that are on turnips or about the paddocks. Sheep out on the hills, provided there is not much snow, will be all right. Hoggets out on native pasture need looking to and shifting out of any dark faces. Some salt-lick placed about in sheltered rock-crevices or boxes will always benefit hoggets and help to keep down worm troubles. If the ground is too frosty to plough there is always plenty for the teams to do carting out hay or straw to racks in the paddocks for cattle, sheep, or horses, and turnips for milking-cows; also carting out stable manure for top-dressing near paddocks. If there are sufficient turnips, calves should get a few with a rackful of hay or straw.

In broken weather there will be wool or crutchings in the shed to clear up, as well as skins to pack for sale. Harness should also be oiled and overhauled in wet weather. Rabbit-poisoning must be pushed on this month when suitable. Gorse-cutting, splitting fencing-material, and other similar work should also be carried out.

AUGUST.

With the arrival of August the busy periods of spring and summer loom up. Much work is ahead, and no opportunity for pushing on should be missed. Ground that has been ploughed during the last few months and may be dry enough can be sown in oats. The ploughing of ground intended for turnips may be also pushed on to help the soil to sweeten and mellow down. It will be as well to carry out any spring dipping this month if possible. If dipped early in spring, sheep that have been wintered on turnips with the intention of holding over for shearing seem to thrive and come along quicker as feed improves, and casting is much lessened.

Sheep out on tussock country will have been tended from time to time, and the shepherd on his rounds, if he has an eye for his work, will note how the sheep are lying on the country, and will see at once where stock may require shifting to fresher spots or warmer faces. Crossbreds, if they have had a rigorous winter, are inclined to get dull and hang in hungry corners where feed may be dirty and scarce, or on

dark faces. If they are not seen to now an unpleasant time is in store as the season goes on, picking up sheep cast from weakness, skinning and plucking dead wool, till the stock gradually improve with the growth of feed, while at shearing-time the amount of heavily matted wool will denote the hard existence these sheep may have experienced. Other stock work will consist of shifting breaks on turnips, and taking off ewes in lamb and putting them in clean paddocks.

There is also always plenty to do looking round and repairing fences, getting young horses broken in, &c. Swamps and low-lying rough places dry enough to burn should have a match put to them this month. Rabbit-poisoning we find most effective in August and September, using phosphorized pollard,* and no opportunity must be missed, as, owing to the scarcity of feed, the rabbits generally take it well. Strychnined oats are also coming into vogue, and this method has recently given some great results.

SEPTEMBER.

September is a very full month. Oat-sowing should be completed and ground worked up for early turnips and grass. Sheep will be requiring more attention as they get heavier in lamb, being more apt to cast. They should therefore be quietly gone through, and not disturbed more than necessary. However, the shepherd on his rounds will find that ewes heavy in lamb will be inclined to hang too much on lower ground, such as river-flats, and will be more liable to cast as they get weaker through eating each other out and dirtying the ground. On clean, fresh, healthy slopes they will be found to cast less, and are stronger. Stud ewes will be lambing this month, and need much attention. Unless the ewes have been well fed they will have little or no milk when the lambs are born. Too much old grass or dry food may produce a like effect. On the other hand, if the ewes have been too well done on turnips or other special feed, milk troubles may arise, such as inflammation of the udder, which may cause death or a diseased quarter.

If possible, the ewes should be lambled on a clean, fresh paddock. When lambing has started the shepherd should visit the ewes in the morning, as then is the time they may be in trouble and assistance required. Another round should be made at midday, and also near night-time. The shepherd on studs or other paddock ewes lambing should never have more than one dog following him—and that a quiet one which will remain with the horse when he is not wanted—as a ewe at sight of a dog will often clear out and leave her lamb. A few hurdles should also be kept handy to whip up a pen in which to put an obstinate ewe that may refuse to take her lamb, or to mother a motherless lamb on to a ewe that may have lost her lamb. When the lambs are a few days old it is a good plan to work them off with their dams into another paddock, thus giving a better opportunity to look after the ewes still

* One of Southland's best pastoral properties, some years ago a perfect rabbit-warren, has been cleared of rabbits simply by the consistent use of phosphorized pollard, poisoning every six weeks until they were put down. Southland can always rely on a rabbit-supply while trapping remains in existence, and while there is a lack of neighbours combining to poison together when weather conditions are favourable. The formation of Rabbit Boards in rabbit districts would certainly tend to enforce combined efforts against the rabbit nuisance.

to lamb. Fences and marking-yards should be seen to, and overhauled if necessary. When marking-time arrives it will be found that ewes and lambs will yard up better if the yards have been set up with an uphill entrance.

Any old tussock country that requires freshening up should be burned this month and no later, as afterwards the tussock-roots may get too dry and frost or dry weather kill the roots. Surface sowing should be carried out on the burned ground straight away, as the ashes may help to cover and germinate the seed better, and also as this is the best period for surface sowing. Fences that may require trimming, such as gorse, should now be cut; and no time should be lost in completing any tree-planting decided upon. Sowing the homestead garden with the season's main requirements of vegetables may also be mentioned.

OCTOBER.

Although October may come in spring-like, it is to be considered the most treacherous month of the year, liable to have as cold and stormy weather as in the winter. There may be a fair growth of feed in the paddocks, but not until November is there much spring in the feed on the pastoral country. Lambing of hill ewes usually starts about the second or third week of this month, and plenty of looking-round without disturbing the ewes is necessary. Good healthy hill ewes that have never seen turnips seldom need any assistance in lambing. Hoggets will need more looking-round, as they will be getting heavier in the wool and more liable to cast. The shepherd should always carry a sack on the saddle, to gather dead wool or skins to some convenient spot from which later they may be brought in. Breeding-cows, which will have been moved in to some place where they may be seen, will also be calving this month, and should be watched daily. Any ewes, such as studs, that have lambed during September will now have lambs ready to mark. A disinfectant dressing should always be used when marking paddock lambs, as there is always more risk of blood-poisoning than with the lambs marked out on tussock country.

If some pollard poison is distributed about rabbit spots (patch poisoning), a good number of young rabbits or runners will get tripped up—given favourable weather. This will help to keep the number down and save feed. In team work there is the carting of seeds, manures, stores, and woolpacks. Intended crops of turnips, also grass, should now be sown.

NOVEMBER.

With November the lambing will be getting well over, and towards the end of the month the run or tussock-bred lambs will be ready to mark. These ewes and lambs should be mustered in cuts or small mobs to marking-yards temporarily erected in their own locality. Under this method after the marking is over and the lambs released the ewes will pick up their lambs quicker, especially if they have been carefully handled into the yard. After marking, the lambs should be held for a while, and then quietly turned in to assist in mothering up. This is a good month for doing any early shearing of rams, ram hoggets, studs, wethers, or hoggets that may have been turniped. Before shearing, the shed should be thoroughly cleaned and disinfected, and this operation should

also be carried out at least once a week during shearing. Teams will be busy working up ground and sowing swedes or hard turnips, ridging being much preferable to drilling on the flat, owing to the increased bulk of feed yielded.

DECEMBER.

Lamb-marking being completed, December usually finds the musterers away getting in the hoggets off tussock country for shearing, also other dry sheep—maiden ewes and wethers. When brought in, after being drafted and strangers taken out and separated, the sheep will be placed in blocks or paddocks handy to fetch into the shed for shearing. About the middle of the month shearers and shed hands roll up, and soon the busy period of shearing gets into full swing. Shearers will have rigged their stands, and are ready with either blades or machines, as the case may be. The classer and his assistants, the wool-rollers, will be busy seeing that the bins are ready, while the pressers will have the press ready and packs and twine handy. While the dry sheep are being shorn the musterers will be away bringing in the wet ewes, also perhaps taking out shorn sheep and placing them on the summer country, usually the highest and farthest out.

With favourable weather the shearing does not last long, and it is all the better for the sheep if they are placed back as soon as possible on their grazing-country. However, shelter for newly shorn sheep—either by blades or machines—must not be overlooked. Nothing is more advantageous than a good plantation securely fenced.* With the teams this is a busy month, hastening along with the turnip-sowing. Hay will also be cut, if available, and made secure.

* I have found the plantations at Mount Linton of much benefit on many an occasion when bad storms have broken out during the shearing, and my thanks are due to the former owner, Mr. Reginald Mackinnon, for his foresight in this matter. There is far too little tree-planting being done these days.

True Breeding of Plant Races.—In my last article dealing with montane tussock-grassland, published in the June number of the *Journal*, there occurs, in the third line from the bottom of page 340, an unfortunate printer's error, "tree-breeding races" of tutu appearing instead of "true-breeding races." This term "true-breeding" is one of fundamental importance, as every farmer must know. A plant may produce offspring of a uniform character, all the individuals closely resembling the parent; or, it may produce offspring far from uniform, with few or no individuals closely resembling the parent. In the former case the plant is said to be "true-breeding," or "to come true from seed"; while in the latter case it is said "not to come true from seed." It is obviously most important to know whether a plant comes true from seed, or the contrary. In nature, there are many true-breeding races, but the outer aspect of a plant generally tells nothing in this regard; while the breeding true of wild races, or species of plants, is nearly always a matter of supposition and not known for certain. Certain knowledge, indeed, can only be gained by rigidly conducted experiments where all sources of error are excluded.—*L. Cockayne.*

MILKING-SHED DRAINAGE.

A DAIRY-FARMER'S GOOD SYSTEM.

J. R. CURLE, Dairy Instructor, Palmerston North.

THE methods practised on large numbers of our dairy farms for dealing with the manure and drainage from the cow-shed and yard are very far from being either satisfactory or sanitary. Notwithstanding all that has been published proving the value of the manure—both solid and liquid—if properly used, it is still all too usual to find that a shovel or hoe, and sometimes a broom, to get the dirt pushed through the stockyard fence is all that is considered necessary. Here the manure is left, to be trodden over by the stock, blown about by the wind, and worked up into a fermenting puddle by the rain, causing a nuisance and a sure source of contamination to the milk, which is usually kept somewhere in the vicinity overnight.

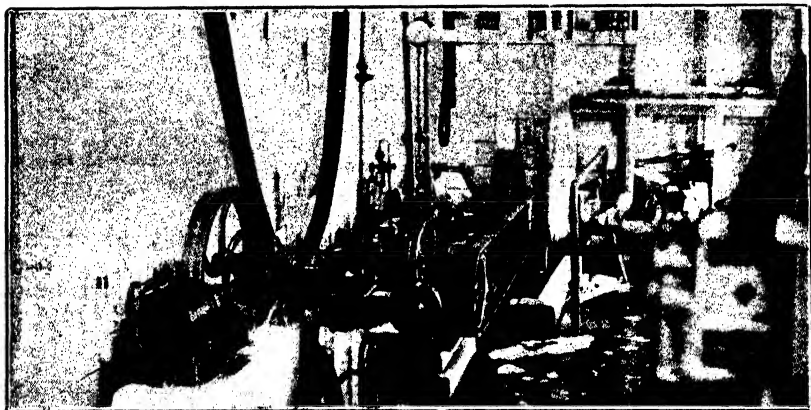
A visit to the farm of Mr. D. Bell, Nircaha, Eketahuna, to view the means used there for dealing in a sanitary and satisfactory manner with the cow-yard drainage would afford an object-lesson to a large number of our dairy-farmers. The shed, built on the ordinary run-through plan, is a picture of neatness, nicely painted, with all plant and appliances in shining condition. Neither the shed nor yard has any drainage proper. The floor is laid with a fall to one corner of the yard. Just outside the yard at this corner there is sunk into the ground a cylindrical iron tank—in this case an old digester from a boiling-down works—of about 500 gallons capacity, with a small aperture on the top, which can be made airtight, the same as a sludge-door on a steam boiler. Into this tank are fitted two pipes. One pipe of 2½ in. diameter goes to within a few inches of the bottom, where it branches in three directions, and reaches about 9 ft. or 10 ft. in the air, with a bend and short length of pipe and tap, high enough for a dray loaded with a 400-gallon iron tank to stand underneath. The other pipe is a ¾ in. one, connected to the tank from an air-compressor in the engine-room. The milking-machine vacuum pump would serve the same purpose, the exhaust being connected with the tank.

All manure from the shed and yard, both solid and liquid, together with the water (of which there is a plentiful supply) used in washing down, is run into this tank through the small aperture on the top, the solids being broken up before entering the tank by passing through a strainer made of three or four pieces of stout fencing-wire.

When the tank is about three-parts full—say, twice a week—the aperture is closed, and the air-compressor used to put a 12 lb. pressure in the tank. The 400-gallon tank on the dray is then put under the tap on the 2½ in. pipe and the tap opened, when the whole contents of the underground tank are forced by the air-pressure exerted up this pipe and into the tank ready to be carted away. The tank has two



MR. BELL'S MILKING-SHED AND YARD AT NIREAHA.



VIEW IN ENGINE-ROOM, SHOWING COMPRESSOR (IN CENTRE).



FILLING TANK ON DRAY FROM THE DRAINAGE-TANK.

plug-holes in the back, and when at the field to be manured the plugs are drawn, and the manure distributed just where required.

This system ensures good use being made of the cow-yard drainage, besides keeping the whole surroundings of the milking-shed in a clean and sanitary state.

A NOTE ON ASPARAGUS-CULTURE.

W. H. TAYLOR, Horticulturist.

FOR some years past the writer has advocated the culture of asparagus on modern lines. By this is meant the elimination of beds, and setting the plants in rows at much greater distances apart than is the custom under the bed method. In old times an asparagus-bed was an institution, almost an heirloom. Comparatively large sums were expended on the preparation of a bed—removal of the subsoil and substitution of top soil and providing large quantities of manure and other material. There is in consequence a widespread idea that the culture of this vegetable is very costly, and that it can be regarded only as a luxury to be indulged in by wealthy people. It is a fact, however, that English market-gardeners give it field culture and do most of the work with the plough, very considerable areas being so planted in England.

The present note was suggested by an item appearing in a recent issue of the *Monthly Newsletter*, issued by the Washington State Department of Agriculture (U.S.A.). The State is divided into ten horticultural districts, and in each there is a horticultural inspector. Each of these furnishes monthly reports on produce sent from his district, particulars of which are published in the *Monthly Newsletter*. In the report from District No. 1, Snake River, Walla Walla Valley, the following particulars are given of car-loads of produce shipped: Onions, 616; cabbage, 27; asparagus, 25; spinach, 28; rhubarb, 60. This makes interesting reading, and one wonders what New Zealand market-gardeners would think of it—asparagus almost equal in car-load bulk to cabbage, and, of course, much in excess as regards weight, and spinach topping both. The large bulk of onions is, of course, not more than would be expected; it merely shows that vegetable to be esteemed as it is with us. The fact stands out that the Americans pay far more attention to asparagus and spinach—both of high diuretic value—than to cabbages. It is patent that they would not do so unless it paid. To make it pay they must adopt modern methods in asparagus-culture.

Asparagus comes in early spring when vegetables are scarce and high in price, therefore fair prices are certain. Field culture produces much larger heads than are obtained by the bed method, which means cheaper handling and higher values. It is not to be supposed that any soil will grow asparagus. First-class soil is required, but given this the culture involves comparatively little labour, and there are no special diseases or pests to deal with. My opinion is that many of our small farmers would find asparagus a profitable crop.

PIG BREEDS AND BREEDING FOR NEW ZEALAND REQUIREMENTS.

K. W. GORRINGE, Instructor in Swine Husbandry.

THE commercial conditions affecting pig-raising in New Zealand seem to indicate a greater demand for bacon, with a lesser demand for pork. In dealing here with the subject of breeds more attention will therefore be given to those breeds most suitable for bacon-production. It is, however, not my intention to decry any particular breed which we have at the present time in the Dominion, but to show where a more profitable return can be obtained by using only those breeds which are most suitable for New Zealand requirements. There is no doubt that the time has arrived for our farmers to seriously take in hand the production of pigs on more scientific and up-to-date lines, as adopted by the leading countries in swine husbandry.

PRINCIPAL BREEDS IN NEW ZEALAND.

The principal breeds represented in New Zealand will now be considered in respect to their qualities and merits for bacon or pork production.

The Berkshire.—This breed is recognized all over the world as very nearly perfect, and in New Zealand it is undoubtedly the most popular one at the present time. This may be attributed to the facility with which it has become acclimatized, and to the high returns it provides for bacon and pork, to its great muscular power, vitality, and constitution, and its marked tendency to resist disease. As an all-round good pig for the farmer it occupies first place. From the bacon-curer's point of view, however, the Berkshire has two drawbacks: it does not possess the proper length of flitch or sides, also it is too thick in the shoulder.

The Middle Yorkshire.—This breed is used extensively here, and can be claimed as second favourite among farmers. It is noted for quickness of growth, early maturity, a good appetite, a hardy constitution, a good coat of hair, and little liability to scald; while it is also a good grazer, feeding and fattening well at any age. The breed may be classed as the most contented, tractable, and readily handled of all pigs. The sows have a good flow of milk and are excellent mothers. The same remark must be made about this breed as for the Berkshire—namely, that it does not possess the length of flitch and is rather thick in the shoulder for bacon, but it makes excellent pork.

The Small Yorkshire.—This breed is not very much kept in New Zealand, and is limited to producers of small porkers. Butchers realize the superiority of the breed as porkers, and do not hesitate to cater for their customers' demands. The short limbs, model forms, and docile disposition are constantly present to the observer, as well as

early growth and a greater capacity to assimilate a maximum of food-constituents which go to make flesh than other classes of pigs. Moreover, their vigorous digestive power is credited with producing a pound of pork at the lowest cost in comparison with other breeds. The easy, even temper and tractable disposition of the Small Yorkshire is great, and will account for its early maturity. Quality supersedes size. The breed is not so good for bacon, and should be used exclusively for pork-production.

The Devon (Large Black).—This breed is fairly well distributed in the Dominion. The Devons have a very contented and happy disposition. It is claimed that the natural carriage of the ears extending over the eyes has produced this, and renders them especially suited for grazing. The breed is also noted for the whiteness and firmness of its fat and abundance of well-streaked lean flesh. The sows make excellent mothers, and the length and depth of carcase provides capacity for large litters, which will range from eight to fourteen each. The sows have well-formed udders, together with a rich supply of milk. The peculiar merit of the breed is their usefulness to the farmer, owing to their ability to live and grow on any class of food, grass, refuse, or vegetables, and readiness to be topped off for bacon at a short notice. But while the breed is specially suitable for bacon in the country where it originated, in my opinion it is not suited for New Zealand conditions on account of its large size; when properly fattened it is too heavy for our requirements.

The Tamworth.—The demand for leaner bacon during the past twenty years has been a great factor in bringing the Tamworth breed into prominence and displacing some of the more refined breeds. The natural stamina, prolificness, and grazing-capacity of the Tamworths, combined with the great delicacy, firmness, and succulence of their flesh for bacon, commend them to the farmer in this country, where pasturage and open grazing are abundant. All doubts as to the Tamworth retaining its qualifications in this climate may be fairly set at rest. This has been amply confirmed by experience. The breed has the reputation of being slow in maturing, but such has not been my experience in New Zealand. Evidently the nature of the climate has produced a reaction towards quick maturity, and in experiments carried out by me the Tamworth has more than held its own with other breeds. Certainly the animals are not handsome, and a first inspection is liable to create a prejudice against them. This, however, is soon got rid of by becoming familiar with their good points in the paddock, at the farrowing-stage, and for the curing-house. Where they have also proved valuable is in crossing with other breeds and further imparting vigour, size, and prolificness to overrefined pure breeds. The progeny of such crosses produces an excellent quality of flesh at a low cost. Tamworth sows are good mothers and free sucklers. A feature specially worthy of record in their favour is their power to resist disease. They are also noteworthy for the facility with which they farrow, and the small trouble they have in rearing large litters. Again, Tamworths have acquired a reputation for docility. They are easily managed, and do not show any disposition to be ill-tempered. My motive for dwelling a little longer on the Tamworth than the other breeds is to emphasize the advisability of paying more attention to the former for crossing purposes.

Other Breeds.—We have also one or two other breeds in New Zealand which to my knowledge have not many qualifications to recommend them to breeders in preference to those mentioned.

BREEDING FOR PORK OR BACON.

In summing up, the question arises, which are the best commercial breeds suitable for New Zealand conditions (1) to breed for pork, and (2) to breed for bacon? In answering I am guided to a certain degree by experiments carried out in America and Britain, but mainly by my own practical experience of thirty years in the Dominion.

As regards breeding for pork, I have come to the conclusion that any of the smaller breeds fulfil the requirements—namely, the Small Yorkshire, the Middle Yorkshire, and the Berkshire.

In breeding for bacon, however, more attention should be given to the growing of pigs most suitable to the demands of the consumer and bacon-curer. What are these demands? In this country we have a standard weight for bacon pigs ranging from 110 lb. to 150 lb. dead-weight. The bacon-curer tells us that the greatest demand is for about 140 lb. net; therefore, with this standard set, it is not wise for farmers to grow others, unless required for home consumption only. The same conditions apply equally for export. Then, again, the curer demands a pig with long “flitches” or sides for rolled bacon. He finds it impossible to roll bacon out of a short-sided pig. In fact, he declares that all the breeds except two—the Tamworth and the Devon—fall short of the required length.

To meet the position we must breed a pig to satisfy all requirements. This is where the Tamworth comes in. By itself it is not suitable, but by using it to cross with the Berkshire and Yorkshire it is of extreme value.

THE TAMWORTH CROSS.

In breeding for the first cross it is better to use a Tamworth boar with Berkshire or Yorkshire sows. Some advise the other way round—a Tamworth sow with a Berkshire or Yorkshire boar. My own experiments, and my opinion based on the best authorities on pig-breeding, are in favour of the former practice. The result of this cross is very favourable, and gives a splendid line of red-and-black-spotted pigs, every one almost alike. The pigs make good baconers, but a further improvement can be made by selecting the sow pigs out of this litter and crossing them back to Berkshire or Yorkshire boars. Of course, the colours will be different on the Yorkshire sow. By the latter cross one obtains what is regarded as the ideal bacon pig—that is, three parts Berkshire or Yorkshire and one part Tamworth. This pig will be raised and fattened for the curer six weeks earlier than any purebred pig. Experiments have proved this without a doubt, and the saving of six weeks' extra food is worthy of consideration. The crossbred sows are the very best that the average farmer can have anything to do with. Combining as they do all the good qualities of both breeds, they are more active—standing higher—and make the most careful of mothers. The Devon has also been used for crossing with the Berkshire and Yorkshire, but, in my opinion, not with such good results. From experience I have found that the Devon has nothing like the robust constitution of the Tamworth, and it is most

essential that constitution be one of the chief aims in mating or crossing for any purpose.

Farmers who live within a short distance of each other, wishing to adopt this system of crossbreeding for bacon, may think that it would hardly pay to buy a Tamworth boar for one or two sows. They could, however, adopt the plan of having a boar on the co-operative system—say, between six or eight—and perhaps then pass it on to another group to use at a certain fee, or follow any other plan which they can arrange between themselves. The co-operative method would work well with some farmers, but with others who do not look after their pigs well it might, of course, not be advisable.

CONCLUSION.

In the vocation of pig-raising breeding is the bedrock of success, irrespective of type. It is clearer now than ever it was that if pigs are worth keeping at all we must pay due regard to their breeding and individual qualities. Pedigree stock are available, and are steadily increasing in numbers and character; their influence is wholly for good. Therefore farmers considering different breeds to choose from must be guided by the surrounding conditions of food, housing, and the class of trade they purpose to cater for.

CONTROL OF BROWN-ROT ON PEACHES.

THE PAST SEASON'S EXPERIMENTS AT ARATAKI.

T. E. RODDA, Manager of the Arataki Horticultural Station.

I. SPRAYING TESTS.

FURTHER experiments were carried out at Arataki during the past season to ascertain if it is possible to control brown-rot on peaches by the agency of any of the recognized fungicidal sprays, applied systematically. The scheme adopted was the same as that carried out during the season 1918-19,* excepting that the trees in a few rows and the ground beneath them were sprayed with sulphate-of-iron and sulphuric-acid solution. This solution was applied during August when the trees were quite dormant. The trees were pruned in the same manner as during the previous year—that is, every alternate tree in each row was treated in the ordinary way by shortening in all the leaders and cutting back all the laterals of any length; the remainder were treated by thinning out wood only; no leaders or laterals were stopped or shortened in. All prunings were carefully raked up and burned. The soil was given a dressing of 6 cwt. per acre of carbonate of lime and ploughed during the middle of August. All the strips that could not be reached by the plough were turned over by the spade. The weather conditions right throughout the test were extremely dry. The different spraying-specifics were applied according to the times and periods laid down in the prearranged plan.

* See *Journal*, May, 1919, page 272.

Practically no brown-rot appeared right up to the time of picking and packing. The highest percentage of infection in any of the plots was considerably below the decimal point. In some of the plots no rot was recorded for the season.

Effects of the different Specifics on Fruit and Foliage.

Lime-sulphur: A locally made lime-sulphur called "Calsulph" was used during the season. It scorched the tender tips and caused the leaves to fall slightly on twenty-three different varieties. The foliage on the other varieties treated with this same lime-sulphur remained normal right throughout the season.

Self-boiled lime-sulphur: A supply of lime was obtained from Te Kuiti for making this preparation. It was a very good quality of lime without any trace of sand. No injury to any of the fruit or foliage was caused by its use; moreover, it had extremely adhesive qualities, a thick deposit showing on the leaves for some considerable time.

Atomic sulphur: As stated in my last year's report, this specific did not injure fruit or foliage in any way.

Sulphur atoms: This preparation appeared to have exactly the same action on fruit and foliage as atomic sulphur.

Sulphate-of-iron and sulphuric-acid solution: This solution did not injure the trees in any way, but it apparently did not produce any different results as compared with the trees that were not sprayed with it.

Summary.

As far as the eye could detect brown-rot was non-existent in the fruit at time of picking, but I am of the opinion that the results were not brought about by the sprays used. I believe that the extremely dry weather was the controlling factor. My opinion in regard to this point has been greatly strengthened by the fact that in some of the adjoining private orchards, where no attempt had been made at control, there was no sign of the disease.

2. CONTROL AFTER PICKING AND DURING TRANSIT.

In the experiments conducted last year it was observed that in numerous instances fruit that had shown no indication of brown-rot at time of picking and packing was badly diseased when opened up in Wellington three days later. In one instance the fruit in a case had developed 29 per cent. of rot.

To test the practicability of dipping and fumigating peaches, after picking, with various compounds against the development of the disease in transit, comprehensive tests were conducted at Arataki this past season. While the results on disease-control were very inconclusive, on the other hand reliable and useful information was obtained of the effect of the treatments on the fruit. A line of treatment was laid down to ascertain if treating either by fumigating or dipping just previous to packing would have any good results. The difficulty at the outset, however, was to ascertain to what strengths the fruit would stand the various gases and dips. Five different pickings were made, and the treatments adjusted according to the effect on the fruit. The packing-benches, fruit-house, and picking-bags were treated with formalin, 1-100, prior to each picking; and the packer's hands were washed in

formalin, 1-100, and then well rinsed in clean water before and after handling and packing the fruit included in each individual treatment, so as to guard against the danger of the chemical on the fruit in one box being affected by that in another case.

The following is a condensed report on the various treatments :—

Dipping.

The fruit was dipped in the various solutions by placing in a scrim bag and allowing it to remain immersed for one minute. It was then placed on a sack that had been dipped in the same solution, and allowed to remain until it was nearly dry before packing. The cases and lids were also dipped in the same solution with which the fruit they were intended to contain had been treated.

Bluestone : At a strength of 1 lb. to 10 gallons and 1 lb. to 20 gallons the fruit was badly marked and not fit for sale, but when reduced to 1 lb. to 40 gallons the solution did not mark the fruit, and apparently the flavour was quite unaffected.

Lime-sulphur : When used at 1 gallon to 30 gallons very little deposit was noticeable, and the taste of lime-sulphur could not be detected on the fruit, even when it was not wiped. At a strength of 1-15 it left too heavy a deposit on the fruit.

Formalin : At a strength of 1 gallon to 100 gallons no markings were noticeable on the fruit, and it apparently did not affect the flavour. When used at 1-50 the fruit was badly marked, making it quite unsaleable.

Permanganate of potash : This was quite safe on fruit at a strength of 2 drams to 1 gallon of water.

Quick-kill : This is a compound manufactured in Auckland, and was used according to directions of 1 lb. to 25 gallons of water. Treatment did not affect the appearance of the fruit, but a slight bitterness was detected.

Dusting.

Bordeaux powder : This caused the fruit to sweat, and as a result the powder became partly dissolved, making the fruit very unsightly. Treatment a failure.

Flowers of sulphur : Even when a small quantity was used the grains were very noticeable on the fruit. It also had the effect of hastening ripening.

Talmard's lime-sulphur powder : This was like flour on the fruit, and could not be readily wiped off.

Fumigation.

For the purpose of fumigating and vaporizing, a fumigator of 100 cubic feet capacity was constructed. The sulphur was burned by placing on a few live coals in a brazier inside the chamber. The formalin and permanganate of potash were evaporated by boiling over a kerosene-lamp inside the chamber. For the purpose of spraying with a fine mist a hole was bored in the side of the chamber to insert the nozzle, which under high pressure gave a very fine misty spray. All fruit treated inside the fumigator was placed in cases, but not packed

before being placed in the chamber. Packing and wrapping were done after taking out of chamber.

Flowers of sulphur: Treatment was quite a failure. Even when used at a strength of $\frac{1}{4}$ oz. to 100 cubic feet for fifteen minutes it marked the fruit very badly.

Formalin: When used at a strength of 2 fluid ounces in 100 cubic feet it had almost the same effect on the fruit as flowers of sulphur. When $\frac{1}{2}$ fluid ounce was evaporated in 100 cubic feet the results were decidedly better in three consignments treated, but the skin of the fruit in one lot was rather much scorched.

Potassium permanganate: This did not affect the fruit in any way when 2 fluid ounces at a strength of 4 drams to 1 gallon were evaporated in 100 cubic feet for thirty minutes.

Mist spray: The practicability of spraying the walls of a confined chamber with a very fine mist spray and allowing the fumes to evaporate was tried, but the treatment was abandoned, as it was not considered practicable to undertake the work on a commercial scale.

Picking and Packing.

As the fruit was picked it was graded into two lots for maturity. Well coloured and matured fruit represented one grade, while matured but poorly coloured fruit represented the other grade. The whole scheme was duplicated on fruit representing the two stages of maturity, picked and treated at the same time. In connection with picking, wrapping fruit against non-wrapping was tried.

Summary.

The fruit was treated and despatched to the headquarters of the Horticulture Division, at Wellington, for observation and report. Untreated check cases were sent forward with each lot. The fruit was examined on arrival, and a record taken of its condition. It was re-examined every second day, and the fruit as it ripened and became fit for immediate retail sale was taken out of the cases. A record was taken of the remainder as it ripened.

In the first three lots very little brown-rot developed after treatment, but the percentage of rot that developed in the fourth picking varied, and was the highest recorded in the trials. This lot was received on a Saturday, and was not opened till the Monday. The weather at the time of picking and during transit of that consignment was very warm and muggy. Probably such weather conditions were extremely favourable for the development of the disease, or possibly the variety under treatment might have been a more responsive host than the varieties previously treated. The delay in examination would also tend to increase the amount of infection.

A good deal of valuable information has been gained regarding the strength at which the various antiseptic compounds can be used. From the point of view of disease-control in transit the experiments were rather disappointing. No marked difference between any of the treatments was noted, but one remarkable feature in the consignment that developed the most disease was the fact that the untreated fruits were the freest from brown-rot.

QUALITY OF ARTIFICIAL FERTILIZERS.

ACTION REGARDING "RADIO MANURE."

As administrator of the Fertilizers Act the Department of Agriculture has the function of watching over the interests of users of artificial manures. The Act provides that every vendor of fertilizers shall register his name and address with the Director-General of Agriculture once a year, on or before 1st July. Before offering any fertilizer for sale the vendor must register its composition, but this information may be supplied at any time before the sale. An invoice certificate corresponding to the information on the registration form must be supplied to every purchaser of 5 cwt. or upwards of fertilizer. Samples of fertilizers are liable to be officially drawn and analysed.

The case here dealt with—that of "Radio manure," manufactured by Radio Manures Limited, Auckland—is given publicity in the *Journal* for the information of farmers and others. It will be noticed that in the legal proceedings the defendant vendor was not the manufacturer of the manure, but a trading firm. While the good faith of the latter is not questioned, the necessity is shown for greater care on the part of distributing merchants.

COURT PROCEEDINGS.

Following is a brief report of the Court case in question :—

At the Magistrate's Court, Marton, on 13th May last, before Mr. J. L. Stout, S.M., Mr. C. H. Schwass, Inspector under the Fertilizers Act (for whom Mr. Izard appeared), proceeded against the branch manager of a well-known North Island commercial firm on the charge of having sold a fertilizer (Radio manure) the analysis of which differed from the defendant's invoice certificate, to the prejudice of the purchaser. Defendant pleaded not guilty.

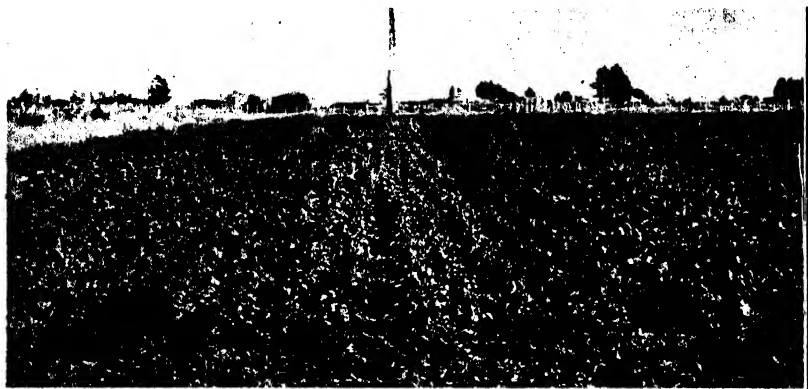
Mr. Ladley, for defendant, raised the preliminary objection that the information should have been against the defendant's company and not against the defendant personally. His Worship noted the objection for consideration.

Mr. F. T. Leighton, Analyst under the Fertilizers Act, gave evidence as to the composition of the sample. The deficiency in phosphoric anhydride amounted to 0.95 per cent., or approximately one-fifth of the amount guaranteed to be present. The value of the deficiency would be about £1 5s. per ton of the mixture, calculated from the unit values. The sample was a low-grade fertilizer, of which the greater portion consisted of coal-dust, the balance being essentially lime and phosphate. The current value of the fertilizing ingredients would be about £4 5s. per ton of the mixture.

Defendant in evidence stated that the fertilizer had been sold in good faith under warranty. Since he had notified the manufacturers of the result of the Department's analysis he had received from them an amended invoice certificate showing a lower analysis. After the Inspector had taken samples witness issued instructions that no more

Radio manure was to be sold, pending the result of the Department's examination. The firm's profit on Radio manure was about 12s. 6d. per ton.

Judgment was reserved. Giving reserved judgment at Marton, on 27th May, His Worship said that he thought Mr. Ladley's objection must be sustained. Defendant was only the servant of the company. The information would therefore be dismissed.



FIELD MANURIAL TRIAL WITH SWEDES AT STRATFORD MODEL DAIRY FARM.

Plot 5 (on right), bone, slag, and super. Plot 6 (in centre), Radio manure. Plot 7 (on left), basic super and blood. Showing contrast in general growth.



SWEDES FROM EQUAL AREAS ON PLOTS 5 (RIGHT), 6 (CENTRE), AND 7 (LEFT), SHOWING CONTRAST IN ROOT-YIELD.

(The middle heap is from the Radio-manure plot.)

FIELD TESTS WITH RADIO MANURE.

Mr. J. W. Deem, Fields Instructor and Supervisor of Subsidized Demonstration Farms, Wanganui, supplies the following account of tests made by him with Radio manure :—

Early last year a manure called "Radio" was brought under my notice and recommended as a substitute for basic slag. On going into

the analysis I found that it was very low in plant-food, containing a total of only 4.98 of phosphoric acid (4.72 of which was insoluble) and 0.66 of total nitrogen. To make up for this deficiency it was stated that the manure had gone through some special treatment, and it was suggested that it contained an unusual amount of radium.* It being the recognized practice to value manures according to the plant-food shown on the analysis, the price asked for Radio—£9 7s. 6d. per ton—seemed to be a great deal above its value as compared with other manures on the market. Calculating the unit values from the selling-price, these were found to be, on the vendor's analysis, £3 16s. per unit for nitrogen (present average price £1 15s.), and £1 7s. per unit for phosphoric anhydride (present average price 12s. 6d.). The cost of the two fertilizer ingredients in Radio was therefore more than double that of the same ingredients in standard fertilizers at the same period.

The low content of plant-food in Radio as shown by the analysis and the high price per unit, coupled with the statement that it possessed some special qualities, suggested a field trial. I therefore purchased a quantity of Radio from one of the registered vendors, and selected a maiden field on the Stratford Model Dairy Farm which had just been stumped and ploughed for the first time, and decided to test it against standard manures in the growing of a swede crop. My reason for selecting this field was the necessity of having maiden land free from the influence of previous manures, in order to scientifically test the value of different fertilizers.

The following tables of results, together with the photographs (on the preceding page), speak for themselves :—

TABLE I.—FIELD MANURIAL TRIAL WITH SWEDES.

Sown 12/12/19, at 10 oz. per acre, through every second coulter ; no after-cultivation ; maiden land. Weighed 12/5/20. Variety, Hurst's Monarch.

Manure.	Rate per Acre.	Yield per Acre.	Cost of Manure.	Percentage of Rot.	Remarks.
	Cwt.	Tons cwt. lb.	s. d.		
1. Basic superphosphate	3	40 3 64	29 3	12.0	Medium top, nice bulb.
2. Basic slag ..	3	36 12 96	31 6	15.0	Not quite so good.
3. Ephos phosphate ..	3	40 13 24	27 9	12.0	Heavier tops.
4. Bone, slag, and basic super, equal parts	3	40 3 64	34 9	8.0	Top growth not so heavy.
5. Bone, slag, and super, equal parts	3	39 13 104	34 9	8.0	Similar to above.
6. Radio manure ..	3	20 14 72	28 1	15.0	Tops poor, roots small.
7. Basic super 6 parts, dried blood 1 part	3½	36 9 72	36 2	20.0	Medium tops, roots fair.
8. Ephos 3 parts, super 1 part	3	41 2 96	28 1	12.0	Heavier top growth.

* Any value this manure may have as a fertilizer is certainly not due to radioactive ingredients, which are present in less quantities than those of ordinary Wellington soil. [Note by the Department's Chemist.]

TABLE 2.—MANURIAL TRIAL WITH SWEDES.

Small plots, sown 15/12/19; drills 22 in. apart; thinned and hand-hoed once; maiden land. Variety, Sutton's Best of All.

Manure.	Rate per Acre.	Yield per Acre.	Percentage of Rot.	Remarks.
	Cwt.	Tons cwt. lb.		
1. Radio manure.. ..	3	17 7 16	14.0	Poor tops, roots small.
2. Control	Nil	17 7 16	22.7	Poor tops, roots small.
3. Basic slag 2 parts, super 1 part	3	30 4 32	37.0	Tops better, fair roots.
4. Ephos 2 parts, super 1 part	3	28 18 64	18.5	Good tops, fair roots.
5. Basic super	3	29 11 48	7.0	Nice roots.
6. Basic super 6 parts, blood 1 part	3½	30 4 32	16.0	Nice roots, tops heavier.
7. Bone, slag, and basic super, equal parts	3	30 17 16	12.0	Nice even roots.
8. Ephos	3	28 5 80	12.0	Fair roots.
9. Walpole guano	3	23 15 80	10.3	Rather small.
10. Surprise guano	3	25 14 32	12.0	Rather small.
11. Basic slag	3	27 12 96	25.0	Fairly even.
12. Super	3	24 8 64	22.2	Rather poor.

FRUIT VARIETIES FOR EXPORT AND LOCAL MARKETS.

THE 1920 CONFERENCE.

J. A. CAMPBELL, Assistant Director of the Horticulture Division.

THE second conference representing the New Zealand Fruitgrowers' Federation, the New Zealand Association of Nurserymen, and the Horticulture Division, convened by the Department of Agriculture for the purpose of considering and recommending varieties of fruit-trees for future planting, was held at the Farmers' Institute building, Wellington, on 29th May last. The delegates were as follows:—

Fruitgrowers: T. W. Atwood, Auckland; A. M. Robertson, Hawke's Bay; T. C. Scott, Nelson; S. I. Fitch, Canterbury; J. D. Bennetts, Otago.

Nurserymen: G. A. Green, Auckland; A. E. Morrison, Warkworth; T. Horton, Hastings; T. Waugh, Wellington; E. Ivory, jun., Rangiora.

Departmental Officers: T. W. Kirk, Director of the Horticulture Division (Chairman); J. A. Campbell, Assistant Director of the Horticulture Division (Vice-Chairman); G. Esam, Orchard Instructor, Wellington; L. Paynter, Orchard Instructor, Waikato; W. C. Hyde, Orchard Instructor, Nelson; W. T. Goodwin, Orchard Instructor, Motueka; J. H. Thorp, Orchard Instructor, Otago.

The objects of the conference were to consider the report issued by the 1916 conference,* and to make recommendations and amendments thereto suggested by subsequent experience as being in the interests of the future development of the fruit industry; further, to consider new varieties of fruit, including those recommended by the previous conference for further testing, and to bring under notice any varieties of promise which may have made their appearance in the meantime.

These matters were carefully considered, but the apple, owing to the dominant position it holds in relation to the fruit industry of the Dominion, called for and received special consideration. Although few alterations were made in the previous lists recommended for planting, the conference particularly wished to emphasize the following points:—

(1.) Owing to the heavy planting of apples since 1909 the success of the fruit industry is almost entirely dependent on the establishment of a reliable apple-export trade, particularly with the Northern Hemisphere, and all subsequent apple-planting and reworking of trees should be done with this in view.

(2.) Notwithstanding the fact that early shipments to the Northern Hemisphere are desirable, heavy planting of such early varieties is not recommended in the meantime other than in districts where a reasonable local market price is assured. This might appear to be a reversal of policy regarding such varieties, but this is not intended. The conference, having regard for the very moderate keeping-qualities of such varieties and the very poor price they command on the local market, merely advises marking time with respect to them until those already planted have sufficiently matured to allow of trial shipments to Europe being made, leaving the results of such shipments to determine the case for or against further planting.

(3.) Although the variety list for local markets is reissued without alteration, intending planters, before planting specially for local purposes, should take into account the fact that in developing an export trade large quantities of apples slightly below export standards will be held for local consumption. They should consider this in conjunction with the supply of late apples now produced, and the comparatively large areas of these varieties which have not yet come into bearing, the whole of which will be confined to the local market other than those required for the South American trade, should the latter be again made available.

(4.) In short, the conference, although it is of the opinion that the varieties given in the different lists are suitable for the purposes named, is strongly of the opinion that the time has arrived in the history of the Dominion when concentration should be made on the two leading mid-season varieties equally suitable to all markets—namely, Jonathan and Delicious. Jonathan is a well-known variety, and its weaknesses are recognized, but these can be overcome under proper cultural treatment. On the other hand, its well-known attractive appearance when properly grown renders it a highly suitable export apple. Delicious has rapidly become a world-wide favourite. It is easily the highest-priced apple of its season in New Zealand at the present time. It has two weaknesses: Firstly, it is somewhat subject to black-spot; but this can be guarded against by timely spraying. Secondly, it is apt to grow somewhat

* *Journal*, March, 1916, page 205.

large ; but this is corrected to a large extent as the tree ages, and in any case this has never affected its popularity. In addition to restricting planting mainly to the two varieties mentioned, the conference is strongly of the opinion that a great amount of good to the industry could be effected by top-working many of the existing trees of undesirable varieties with Delicious.

(5.) The conclusions of the previous conference relative to the Sturmer apple were confirmed—namely, while fully appreciating the many excellent qualities of this variety, the fact that it reaches maturity too late to allow of heavy shipment to European markets should not be overlooked.

(6.) Growers are advised to consider the possibility of a pear-export trade with the United States of America. Many favourable reports relative to this have recently come to hand. New Zealand is in direct communication with both the east and west coasts of that country, thus enabling huge markets to be tapped. The varieties of pears recommended for export appear later in this report.

Before adjourning the conference carried a resolution strongly favouring the holding of a varieties conference at least every other year.

The following subjects were dealt with by the conference, and varieties recommended to suit :—

(1.) Apples and pears for Northern Hemisphere markets.

(2.) Apples for South American markets.

(3.) Apples, pears, peaches, nectarines, plums, prunes, cherries, and apricots for local markets.

The varieties recommended are as follows :—

NORTHERN HEMISPHERE.

APPLES: DOMINION LIST.

Gravenstein ⁽¹⁾ .	Dunn's (Monroe's Favourite) ⁽⁵⁾ .
Golden Pippin ⁽²⁾ .	Cleopatra.
Willie Sharp ⁽³⁾ .	Scarlet Nonpareil.
Cox's Orange ⁽⁴⁾ .	Rome Beauty.
Jonathan.	Statesman.
Delicious.	Sturmer ⁽⁶⁾ .

⁽¹⁾ Very suitable for early shipments. Brings good price on local markets.

⁽²⁾ Keeping-qualities doubtful. Does well in Auckland District. Very suitable for canning.

⁽³⁾ Hardy, blight-proof tree ; heavy bearer. Fruit keeps well for season.

⁽⁴⁾ Excellent quality ; indifferent bearer. Subject to bitter-pit. Probably enough already planted.

⁽⁵⁾ Not high class. Enough of this variety already planted.

⁽⁶⁾ Excellent all-round variety, but somewhat late for heavy shipment to Europe.

APPLES: DISTRICT LISTS.

The representatives of the various districts selected from the Dominion list of varieties recommended for the markets of the Northern Hemisphere those varieties best suited for their particular districts, as follows :—

Auckland.

Gravenstein.	Delicious.
Golden Pippin.	Rome Beauty.
Willie Sharp.	Statesman.
Dunn's (Monroe's Favourite).	Sturmer.
Jonathan.	

Hawke's Bay.

Gravenstein.	Delicious.
Willie Sharp.	Dunn's (Monroe's Favourite).
Jonathan.	Sturmer.

Wairarapa and Wellington.

Gravenstein.	Delicious.
Cox's Orange.	Dunn's (Monroe's Favourite).
Jonathan.	Sturmer.

Canterbury.

Cox's Orange.	Rome Beauty.
Jonathan.	Statesman.
Delicious.	Sturmer.
Dunn's (Monroe's Favourite).	

Nelson.

Cox's Orange.	Dunn's (Monroe's Favourite).
Jonathan.	Statesman.
Delicious.	Sturmer.

Otago.

Gravenstein.	Scarlet Nonpareil.
Cox's Orange.	Rome Beauty.
Jonathan.	Statesman.
Delicious.	Sturmer.
Cleopatra.	

SOUTH AMERICA.

APPLES: DOMINION LIST.

Jonathan.	Cleopatra.
Delicious.	Yellow Newtown Pippin.
Dunn's (Monroe's Favourite).	Rome Beauty.
London (Five-crown) Pippin.	Statesman.
Lord Wolseley.	Sturmer.
Dougherty.	

LOCAL MARKETS.

APPLES: DOMINION LIST.

Beauty of Bath.	Delicious.
Red Astrakhan.	Dunn's (Monroe's Favourite).
Lord Suffield.	London Pippin.
Gravenstein.	Lord Wolseley.
Golden Pippin.	Cleopatra.
Scarlet Pearmain.	Yellow Newtown Pippin.
Worcester Pearmain.	Rome Beauty.
Cox's Orange Pippin.	Statesman.
Alfriston.	Sturmer.
Jonathan.	Dougherty.
Reinette du Canada.	Ballarat.

PEARS: DOMINION LIST.

Beurre Bosc.	Gibbins Nelis.
Beurre Capiaumont.	Glou Morceau.
Beurre Clairgeau.	Josephine de Malines.
Beurre d'Anjou.	Marie Louise.
Beurre Diel.	P. Barry.
Doyenne du Comice.	Twyford's Monarch.
Directeur Hardy.	Winter Cole.
Durondeau.	Winter Nelis.

The conference reaffirmed the resolution passed by the previous conference warning intending planters against very extensive planting of any variety of pears for local markets, particularly the early and mid-season varieties. Planting for the local markets should be mainly confined to the later keeping varieties, selected to suit the locality, from the following (which are also highly suitable for export) :—

Beurre Bosc.
 Twyford's Monarch.
 Doyenne du Comice.
 Winter Cole.

Winter Nelis.
 Josephine de Malines.
 P. Barry.
 L'Inconnue.

The following varieties may also be grown with satisfaction in localities having canning-facilities :—

Williams' Bon Chrétien.

Keiffer's Hybrid.

If, however, a rotation of pears is desired, the following should prove satisfactory :—

Williams' Bon Chrétien.
 Louise Bonne of Jersey.
 Packham's Triumph.
 Conference.
 Beurre Diel.
 Beurre Bosc.

Doyenne du Comice.
 Winter Cole.
 Winter Nelis.
 P. Barry.
 L'Inconnue.

STONE-FRUITS: DOMINION LIST.

PEACHES.

D. denotes dessert ; C., canning ; W., white flesh ; Y., yellow flesh ; F., free-stone ; Cl., clingstone ; and S.Cl., semi-clingstone.

Early Varieties.

Sneed D.W.F.
 Briggs' Red May⁽¹⁾ D.W.F.
 High's Early Canada⁽²⁾ D.W.S.Cl.

Second-early Varieties.

Hales D.W.F.
 Wiggins D.W.F.
 Carman D.C.W.S.Cl.
 Delicious D.Y.F.
 Peregrine D.W.F.

Mid-season Varieties.

Elberta C.Y.F.
 Kalamazoo D.C.Y.F.
 Up-to-Date D.C.Y.F.
 Kia Ora D.C.Y.F.

Late Mid-season Varieties.

Paragon D.C.Y.Cl.
 Muir D.C.Y.Cl.

Late Mid season Varieties -- continued.

Sea Eagle Improved D.W.F.
 Wheatland D.C.Y.F.
 Prizetaker D.W.F.

Late Varieties.

Lippiatt's Late Red D.W.Cl.
 Golden Queen D.C.Y.Cl.
 Solway C.Y.F.

Additional Varieties.

Mayflower.
 Sanders.
 Alexander's Early.
 Royal Charlotte⁽³⁾.
 Housted's Early.
 Le Varuguer.
 Osprey Improved.
 Hobbs's Late.
 Lady Palmerston⁽⁴⁾.

⁽¹⁾ and ⁽²⁾ Retained for benefit of Central Otago.

⁽³⁾ Not well known. Included for benefit of Hawke's Bay.

⁽⁴⁾ Not in favour in Auckland.

NECTARINES.

Ansenne.
 Cardinal.
 Early Rivers.

Goldmine.
 Hunt's Tawny.

PLUMS (ENGLISH).

Angelina Burdett.	Greengage.
Coe's Golden Drop.	Jefferson.
Damson-Russian.	Kirk's.
Diamond.	Magnum Bonum (Yellow).
Early Orleans.	Monarch.
Early Rivers.	Bond's Seedling.
Evans's Early.	President.
Grand Duke.	Takapuna Drop.

PLUMS (JAPANESE).

Burbank.	Sharp's Early.
October Purple.	Wright's Early.
Satsuma.	Sultan.

PRUNES.

Golden Prune.	Petite d'Agen ⁽¹⁾ .
Giant.	Tragedy.

⁽¹⁾ Cracks badly in some districts.

APRICOTS.

Bolton.	Cullin's Early.
Hemskirk.	Royal Late.
Moorpark.	Roxburgh (large red).
Newcastle.	

CHERRIES.

The following are recommended for planting :—

Bigarreau Twyford.	May Duke.
Early Purple Guigne.	Early Lyons.
Early Rivers.	Bedford Prolific.
Black Eagle.	White Heart.
Bigarreau Jabaulay.	Knight's Early Black.
Florence.	St. Margaret.
Black Tartarian.	Werder's Early Black.
Bigarreau Napoleon.	

VARIETIES FOR FURTHER INVESTIGATION AND TESTING.

Reports submitted by the Department on varieties of apples recommended by the previous conference for testing were considered. The following varieties and classes of fruits were recommended for further investigation and report, including testing where necessary. In this connection the conference resolved that these matters should not be left entirely to the Department, but that growers should assist in every way possible, keeping the Department informed of the results of their investigations for the benefit of a later conference.

APPLES.

Glengyle's Red.	Albany Beauty.
Grannie Smith.	Rival.
King David.	Late Market.
Marian Red.	Salome.
New Gold Pearmain.	Beecroft.
Brighton (Patoka).	Shepherd's Perfection.
Premier (Nelson).	Bonum.
Shorland Queen.	Giant Jenneton.
Stayman's Winesap.	White Winter Pearmain.
Parlin's Beauty.	Tasma.
Ranelagh.	

NECTARINES.

Grand Admiral.
Lily Baltet.

Mrs. D. Chisholm.
Victoria.

PLUMS (ENGLISH).

Reine Claude de Bavay.
Victoria.

Washington.
Denyer's Victoria.

PLUMS (JAPANESE).

Doris.
Maynard.
Santa Rosa.
Ngata.

Bellena.
Formosa.
Hermosilla.

APRICOTS.

Marlborough.

CHERRIES.

Fruheste Der Mark.
Claremont.
Centennial.
Black St. Margaret.
Chapman.

Gean d'Annonay.
Bellelleu.
Noble.
Bing.

NOTE. Mazzard and Gean are considered to be the best cherry-stocks.

ARTIFICIAL BROODING OF CHICKS.

AN IMPROVED FIRELESS BROODER.

F. C. BROWN, Chief Poultry Instructor.

PARTICULARS and illustrations are here given of a simple style of fireless brooder that has been used with great success at the Avonhead Training-farm and Cashmere Sanatorium for returned soldiers, at Christchurch. It has also been worked with favourable results by some of the leading poultrymen of Christchurch. It first came under my notice when being used by Mr. F. Ward, of Hornby, who, to the best of my knowledge, was the originator.

There are many different styles of fireless brooders for rearing artificially hatched chicks, and this one, like all others, can only prove successful when certain primary essentials have been observed. The first thing necessary is to see that the parent birds are fed and managed in such a way that eggs will be produced containing the desired strength of germ to produce a strong healthy chick. It may be safely said that success or otherwise chiefly depends upon the health and vigour of the chicks when placed in the brooder. Breeding from overfat hens that have had insufficient exercise, or birds that have been forced for heavy laying, is a common cause of delicate chicks being hatched and heavy mortality taking place during the brooder stage. Weak chicks may be reared in a heated brooder, but with the fireless type this is a most difficult task. Indeed, it is one of the great advantages of the fireless brooder that weaklings usually die off during the first few days. There-

fore the greater the number of these weaklings the greater will be the number lost. If the breeding-stock are properly managed and the chicks are strong when put into the brooder it can be depended upon to do the rest, providing, of course, that both brooder and chicks are handled in an intelligent manner. Like any other brooder, this one is not fool-proof. Even with the strongest of chicks failure is inevitable if the little details which go towards success are not observed in every respect.

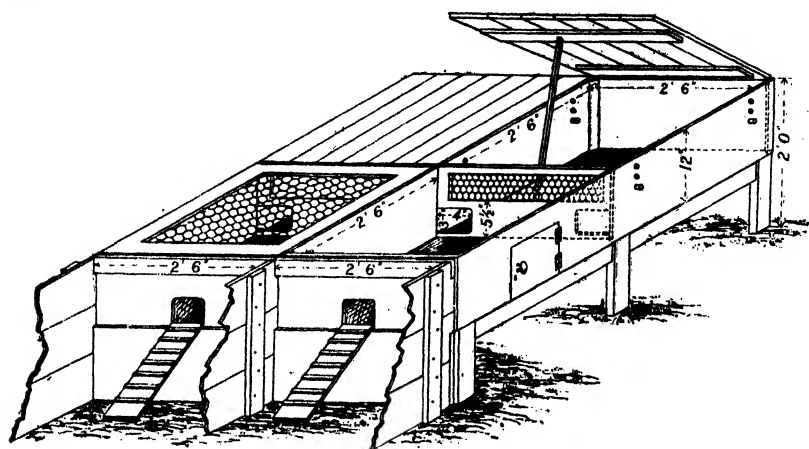


FIG. 1. THE DOUBLE FIRELESS BROODER.

Part of inside runs showing in front.

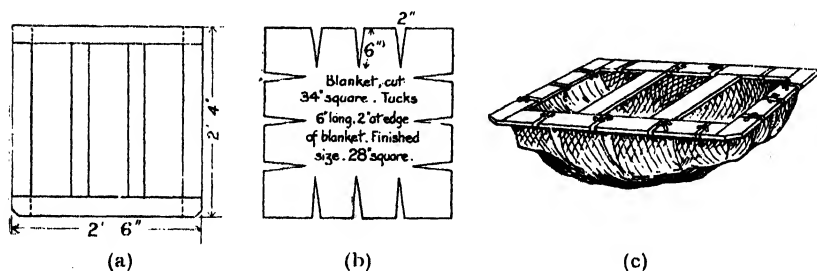


FIG. 2. DETAILS OF HOVER.

(a) Frame; (b) blanket cut to shape; (c) blanket attached to frame.

For the work of rearing chicks by artificial means it is next to impossible to lay down any hard-and-fast set of instructions that must be followed. It should be remembered that the best brooder ever made is merely a substitute for a natural process, and that if success is to be achieved the only safe course is to take an object-lesson from the natural mother with her brood. It will be noticed that for the first few days her whole endeavour is to keep the chickens under her wings for the purpose of keeping them warm and comfortable, while at the same time they are given an opportunity to breath fresh air—that

great essential for their welfare. It will also be seen that the hen does the hardening-off process by degrees. At first only a few minutes are allowed the chicks to feed and exercise, when she calls them back to the warmth of her body. As they grow older the time given to exercise is extended, but at no time does she neglect to give them a warm-up when required. The hen studies the weather, and time for exercise is allowed according to it. So also with the brooder under notice, the system of management must be varied according to the season of the year and local conditions generally. Not only the weather but also the appearance of the chicks must be studied from day to day, and the conditions varied accordingly.

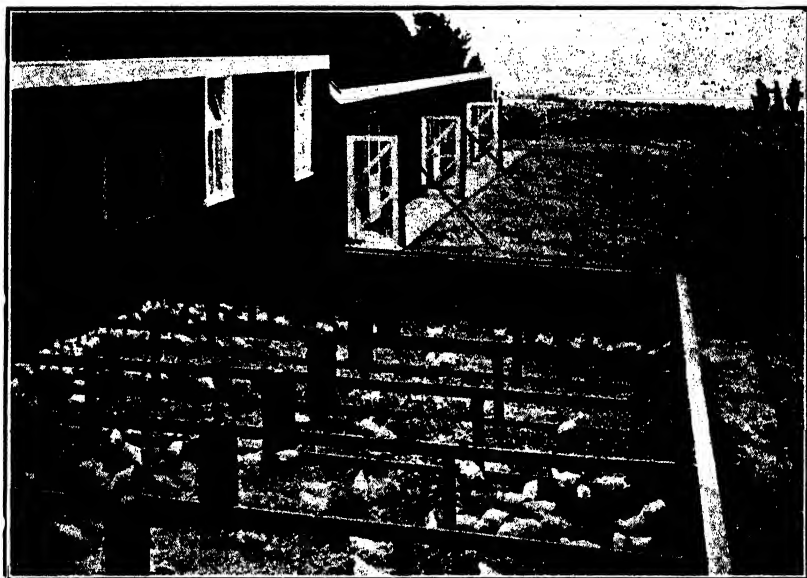


FIG. 3. VIEW SHOWING OUTSIDE RUNS AT THE CASHMERE PLANT.

SOME DETAILS AND POINTS.

The accompanying illustrations of the brooder are so plain that a lengthy description of its construction is unnecessary. The following details and points, however, may be useful :—

The brooder may be made double or single, according to requirements. The sides, ends, and centre boards are made of 12 in. x 1 in. timber, and the bottom of floor-boards. The hover-frame is made of 2 in. by $\frac{1}{2}$ in. material, and measures 2 ft. 6 in. by 2 ft. 4 in. It is supported by movable wooden pegs placed in holes in the sides of the brooder, the bottom holes being $5\frac{1}{2}$ in. above the floor. On the underside of the hover a piece of blanket is attached with pieces of tape here and there. It is necessary that the blanket have sufficient sag to actually touch the floor. This can be best arranged by using a piece of blanket 34 in. square and cutting out V-shaped pieces 2 in. wide by

6 in. long, as shown in Fig. 2 (b). Sew the edges together where the V pieces have been cut out. This will reduce the size to 28 in. by 28 in., which will give the desired sag when tied to the frame as directed. On top of the hover-frame two $2\frac{1}{2}$ in. by $\frac{1}{2}$ in. battens are fixed as supports of any additional covering that may be used, the object being to keep the weight of this off the chicks' backs, which is most important. As a rule a clean grain-sack doubled in two will provide sufficient covering in addition to the blanket during the early stages. This extra covering should, of course, be reduced as the chickens develop.

Care must be taken that the sack does not touch the end of the brooder-box or the system of ventilation provided will be interfered with. The principle of applying ventilation with this brooder without subjecting the chicks to draught is probably its strongest advantage over most other systems. It will be seen that the fresh air enters through the openings in the front board, and passes out at the back of the hover, where there is a space of about 1 in. by $\frac{3}{4}$ in. It then travels over the top of the hover and comes out through the wire netting in front. The latter is merely to act as a means of preventing the chicks from jumping on top of the hover.

When the chickens are young it is important that the hover-frame fits closely on top of the front board of the hover section. It is also important that the openings for the chicks to enter and leave the hover section be never closed, except with a piece of small-mesh wire netting. Fixed on four bent nails, this will prevent the chicks, when young, from leaving the hover section, while at the same time the admittance of fresh air will not be cut off. The lid covering the hover is made of tongued-and-grooved boards.

For bedding, dry straw chaff is recommended. To prevent draught the floor is covered with newspaper before the chaff is placed thereon. To lessen the risk of the chicks becoming chilled when first placed in the brooder the chaff should be previously made warm by means of a hot brick, the brick to be removed before the chicks are put into the brooder. For the first few days, and after allowing the chicks a few minutes to feed, they should be gently pushed back under the hover, as, having no artificial heat to induce them to go under it, they are apt to stay out too long and become chilled. When the youngsters have learned to run in and out of their own accord, access to the second chamber should be given them at all times. From this on increase their liberty by degrees until the outside runs are reached.

This (single) brooder will accommodate from sixty to seventy chicks for the first three weeks, after which time the number should be reduced. When more than one brooder is being used a space of about 18 in. should be left between each, so that the chicks can be attended to from either side, while a convenient space should be left between the end of the brooder and the back wall of the house. As a matter of convenience the brooder should be placed on a stand 1 ft. high. The inside runs are boarded up 2 ft. high. To prevent the chicks from flying over, light-movable wooden frames covered with wire netting are placed on top.

A brooder-house is best made on the lean-to style, 8 ft. 6 in. high in front and 6 ft. 6 in. at back. To provide ample space for the chicks to exercise during wet and cold weather it should be at least 16 ft. deep. The house should be opened up in front according to local weather

conditions, the opening being covered with sparrow-proof wire netting. Usually an opening of 3 ft. in height will be suitable for most localities. On the inside above the opening, wooden frames covered with sacking or other suitable material should be hinged and arranged in such a way that they can be raised or lowered according to weather conditions.

The outside runs are 2 ft. 6 in. high. The division fences are made of wooden frames covered with 1 in. wire netting, which fit into slots fixed to the posts. The top of the runs is covered with 6 ft. wire netting of 2 in. mesh. With this arrangement the runs (except the posts) can be readily taken down in the off season and put under cover, while the ground can be dug up and sown down.

PHOSPHATES : THE PRESENT POSITION.*

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

NEW ZEALAND farmers are now spending about half a million sterling annually on manurial phosphates, all of which—with the exception of a comparatively small amount of locally produced bonedust and mineral phosphate—have to be imported from other countries. Unless our agricultural practice is very much in error, the phosphate-supply is a highly important matter to New Zealand, and one which merits the closest study from all who have the welfare of the Dominion at heart.

It is in the North Island, particularly the northern portion of it, that—under the present system—heavy phosphatic manuring has proved so necessary. Fortunately, our needs were well put forward at the Peace Conference, and the result is the Dominion's present interest in Nauru Island, which assures a supply of the highest grade of naturally occurring phosphate in the world. This phosphate contains over 80 per cent. of phosphate of lime, whereas basic slag and ordinary superphosphate contain phosphate equal to less than half that quantity. There can be manufactured, however, what is called a double superphosphate, which would contain more than double the quantity that ordinary superphosphate contains, and which, if landed in New Zealand, would save half the cost of freight, handling, and bags. It would have to be mixed up with a diluent before use.

Why then, it may be asked, is it necessary to import from Japan, Europe, and Australia slag and superphosphate when we have at our doors high-grade phosphate? The answer is easier to give for superphosphate than for basic slag. Superphosphate is soluble in water. It is therefore, when applied to the soil, quickly dissolved in the first rain, and reprecipitated in very fine particles all round the plant-roots, which quickly absorb it. Superphosphate has a greatly stimulating effect on the young growing plant, inducing a vigorous growth at the most critical period of all forms of life—infancy. In cruciferous plants like the turnip, with a poor root-system and a capacity for metabolizing sulphur compounds, superphosphate has the added advantage that it

* Substance of an address to the Annual Conference of the New Zealand Council of Agriculture, Wellington, July, 1920.

greatly stimulates root-growth and also contains sulphur compounds—differing in this respect from both phosphate rock and basic slag. In shallow limestone soils, or in soils in which droughty conditions obtain, superphosphate is the favourite phosphatic fertilizer, and it is not likely that phosphate rock (often erroneously called guano), however finely ground, will wholly take its place. Basic slag undoubtedly gives marvellous results in most cases, but I am not certain that its place will not eventually be taken by finely ground phosphate rock of high grade. It will be remembered that field experiments conducted by well-known agricultural professors at Cockle Park, at Aberdeen, and in Essex showed that rock phosphates were but little inferior as a source of phosphoric acid to the higher grades of basic slag. If this be true of the colder soils of Britain it is more likely to be true of the warmer, quicker soils of New Zealand.

With basic slag the case is different. It is, like phosphate rock, an insoluble phosphate, though more soluble in soil-water than phosphate rock. Its most fitting use is as a top-dressing for pasture on poor soils in a moist climate. According to English experience its effectiveness used to be limited to clay soils, but I have proved that it is equally effective on sandy or light pumice soils in New Zealand, provided the rainfall is sufficient and climate generally moist enough. In discussing basic slag it must be mentioned that an important meeting was recently held in London under the auspices of the Faraday Society, at which the subject under discussion was "Basic slags—their production and utilization in agricultural and other industries." The meeting, it appears, was called for the purpose of getting together those interested in the manufacture and use of basic slag, in order to endeavour to increase its value to the farmer without unduly adding to the cost of producing the main product—steel. The directions in which it is thought that the value of slag could be increased are (1) by producing a more uniform product, (2) by making the phosphate more available, and (3) by increasing the output by adding more phosphate to the slag, either in the molten condition or in grinding, or by other mechanical methods. A point which should be noticed is that very large quantities of open-hearth basic slags are now produced containing 5 to 8 per cent. of phosphoric acid which it is impossible to market on account of the high cost of freights, grinding, and bagging. If it were possible to increase the percentage of phosphoric acid in these slags up to 10 per cent. it would then be possible to market them. To effect this it is necessary to obtain the co-operation of the steel-manufacturers. It is satisfactory to learn that the meeting resolved to refer the matter to the Ministry of Agriculture with the view of taking the matter up with the Iron and Steel Institute.

Another point which strikes one in reading the report of this meeting and the remarks of the president, Sir Robert Hadfield, that the Faraday Society had already done good work in getting the nitrogen-products committee set up is that the viewpoint of Great Britain with regard to fertilizers is essentially different from that of Australia and New Zealand. The dominant fertilizer demanded by Great Britain is nitrogen, and the anxiety has always been in the direction of obtaining supplies of this for the wheat crop and for manuring generally. After utilizing the locally produced sulphate of ammonia, this nitrogen comes mostly from Chile (nitrate of soda). The phosphates required by Britain have been easily obtained from Europe, North Africa, and the eastern and southern

parts of the United States of America. Until the war upset things there does not seem to have been much concern expressed about phosphates. The difficulty seems to be for Britain to realize that phosphates are just as real a necessity for New Zealand as nitrogen is for Britain. The moral, if New Zealand wishes to be considered in the distribution of the phosphates of the world, is to act now, for it certainly looks as if—with the advancement of knowledge in extracting manurial nitrogen from the air, and possibly the cheapening of potash salts owing to new sources of supplies—phosphate may become the limiting factor in intensive agriculture. It must be borne in mind that, although the earth's crust contains something over 2 per cent. of potassium and the air 75 per cent. of nitrogen, the earth contains only 0.1 per cent. of phosphorus. Americans see hope in the discovery in their vast continent of new deposits of phosphate, and certainly this appears to be the most reasonable ground for hope. Phosphates, however, are not such an easy thing to discover. When a scientific people can be guilty of the mistake of metalling roads with phosphate rock—which has happened more than once—it will be realized that vast deposits may yet await the lucky chance or the patient explorer that may bring them to light in areas where they are now unsuspected.

In this connection I would like to draw your attention to the extraordinary way in which the known phosphate deposits are distributed over the earth. On looking at the map published in the *Journal of Agriculture* for August, 1915 (p. 113), it will be seen that there are no phosphate deposits known in the great land-masses to the east of a line drawn through India to Siberia, none in South America, and none in South Africa. There may be a geological reason for this, but the most obvious explanation seems to be that the phosphate deposits do exist in those countries but have not yet been discovered. The Chinaman is at great pains to preserve all waste products which contain phosphate. He is amazed at the waste incurred in our Western methods of sewage-disposal—a system which, every year, for every million adults sends to the sea phosphate equal to 7,000 tons of pure phosphates of lime. But the Western world would find an element of humour in the situation if available phosphate deposits were discovered in China, after all the centuries in which these Eastern races have been so tenderly saving and utilizing their waste products in order to maintain the fertility of the soil sufficiently to grow their staple cereal, and one having the least nutritive value of any—rice. However, as Europe has recently been helped by islanders, so may the Eastern continent by Japan, who has already found phosphates within her own borders, and has learnt to fertilize the paddy-fields with phosphate.

I think enough has been said to show the importance of a phosphate-supply for New Zealand. Granted that adequate supplies can be obtained from the Pacific islands, will the farmer be able to continue paying the price for such heavy dressings as are now the practice; and, if not, how can the burden be lightened? A correct appreciation of the situation might mean considerable study, after having all the data which accurate field experiments could give. As a step in the right direction, one would like to see a proper estimate prepared of the available resources in the Dominion, including the deposits of Clarendon, Milburn, and the islands lying off the coast near Dunedin, which contain deposits of aluminium phosphate. The latter is a form which is now

being imported from Australia under the heading of "Victorian phosphate"; but we know nothing of the value of this form of phosphate on New Zealand soils. Then, as I have before advocated, accurate field experiments are required on the possibility of economizing phosphates by the use of lime, following Hilgard's dictum that on soils rich in lime much less phosphate is required than on soils deficient in lime. Further, there are many vexed questions to deal with regarding the proper form in which to apply phosphates and lime, and as to the real value of nitrogenous and potassic manures for North Island conditions, requiring several years careful experimenting in the field on different types of soil and in different climates. If the statement that 100,000 acres of pasture land in the Dominion are yearly reverting to scrub and fern is not an exaggeration, the position is sufficiently serious to warrant a large expenditure on experimental work in order to find out how the trouble can be remedied; and adequate manurial treatment, where the country is suitable, may be the cheapest way of combating this retrogression of pasture land. On pumice lands, for instance, with pasture going back to fern, complete cures have been established by top-dressing with phosphates.

In conclusion, I would offer this advice to those who are concerned with the development or maintenance of the fertility of New Zealand lands: Make phosphate the chief manuring, and strive after the finest possible grinding, remembering that phosphate becomes less available to plants in the soil, and in this respect differs from lime or limestone, which becomes more available. Hence limestone may be ground much more coarsely than phosphate, especially phosphate rock, which should always be applied in the finest impalpable flour. Get the highest grade of phosphate you can—over 80 per cent. if possible—but do not use any low-grade phosphate of unknown origin, or aluminium phosphate, or mixtures containing this, until it has been tested on New Zealand soils. Contemporaneously with phosphate treatment develop the limestone resources of your district. Now that we have the Lime Committee actively at work, and I have the full sympathy and support of my two colleagues—Messrs. Furkert and Morgan—advice will be freely and, I hope, quickly given on all points connected with the development of the limestone resources of the Dominion, whether it be a matter of chemistry, engineering, or geology. Make good use of the Instructor in Agriculture in your district, and get him to take careful and accurate samples of the typical soils—not taken foolishly or selfishly in one or two paddocks of one particular man, but across the face of the country from situations which a committee of farmers knows to be similar. The taking of these well-drawn representative samples will be of great value in determining what amount of lime each district requires.

Sale of Fruit.—Some 7,600 registered numbers have been issued under the regulations relating to the sale of New-Zealand-grown fruit for consumption within the Dominion.

Limestones.—Samples of limestone from various localities recently tested by the Chemistry Section gave the following percentages of carbonate of lime: Utiku, 66; Morrinsville, 71; Kara, 56; Dairy Flat, 78 and 79; Kaipara, 89 and 69; Marohemo, 75.

TOMATO VARIETY TESTS.

DURING the past season tomato variety tests were carried out by the Horticulture Division at Tauranga, Havelock North, Nelson, and Christchurch. Seeds were obtained from various sources of varieties grown for commercial purposes. A portion of the seed of each variety was sent to the different centres so that all might have the same strain. The following varieties were grown in each place: Selected Large Red, Selected Kidson, Sparks's Earliana, Chalk's Early Jewel, Dreadnought, Russian, Stokell, Clark's Favourite, Fillbasket, Holmes's Ideal, Hillside Comet, and Kondine Red. Reports from three of the four growers favour Selected Kidson and Selected Large Red, one placing Selected Kidson first. The fourth grower (Christchurch) places Stokell first, with Russian and Holmes's Ideal very close to it.

These trials were undertaken at the request of a number of Nelson growers who desire to obtain varieties better than those they are growing. With regard to this, it may be said at once that growers should rely on their own selection rather than on any particular variety. In all seedling crops variations are observable. This is particularly noticeable where there has been no selection. A tomato-grower should search his plantation for a plant or plants that exhibit the desired characteristics, save seeds from such plants, and follow up the process of selection till he gets a stock with the qualities desired. The chief characteristics desired are setting of the first bunch near the ground, short internodes, regular setting of fruit throughout, fair fruit and bunches, and ripening of the top bunches in good time. The value of selection is proved by these trials, seeds of the variety that found most favour having been obtained from one of the most successful tomato-growers in the Dominion and being from a carefully selected strain.

The fact that Selected Kidson and Selected Large Red were condemned only in the Christchurch tests requires explanation. The whole of the plants were badly checked by frost early in December, which had the effect of seriously reducing the crop. This resulted in the larger varieties producing abnormally large fruit unfit for market, while the smaller varieties gave fruits probably of larger size than would have been obtained had there been a full crop. For this reason the Christchurch tests must be regarded as, to say the least, not conclusive. It is also a fact that the Christchurch market requires small or medium-sized and round fruits. Whether this is entirely a desire of the consumers or has been brought about by the growers is not of any moment: It is so, and other types are not popular. Quite the opposite is the case in the Wellington market.

With regard to this matter it is quite certain that public taste can be guided, also that it has prejudices that can be overcome. It is not true that all round varieties are superior in flavour to all corrugated fruits; some are, others are not. A selection from corrugated varieties that will satisfy the market can be found. The only question the grower has to decide is how to get the best return for his labour. Small fruits

command most money per case, but the small fruits cost more to produce. An extra sixpence or even more per case is more than lost by the extra cost in gathering and packing. There is abundant and positive evidence that most money is made by growing a fair-sized fruit.

—*Horticulture Division.*

TESTING OF PUREBRED DAIRY COWS.

CERTIFICATE-OF-RECORD LIST FOR THE HALF-YEAR.

W. M. SINGLETON, Assistant Director of the Dairy Division.

THE appended lists give particulars of the records of those cows and heifers which have qualified for certificates this year up to the end of June. The numbers are small owing to the fact that few cows finish their test during the first six months of the year. Many cows, however, are now nearing the end of their lactation period, and for the remainder of the year a large number of records will be reported.

RECORDS FROM 1ST JANUARY TO 30TH JUNE, 1920.

Name and Class of Cow.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS.						
<i>Junior Two-year-old.</i>		Yrs.dys.	lb.		lb.	lb.
Gamboge's Wonder	J. K. Richards, Kapuni	1 332	240·5	365	6,968·2	440·94
Duke's Nancy ..	E. Harding, Woodville	1 293	240·5	282	4,804·3	273·05
<i>Senior Two-year-old.</i>						
Patricienne ..	R. F. Wilkinson, Pukekohe	2 264	266·9	343	7,668·3	409·86
<i>Four-year-old.</i>						
Springfield Rosemary	C. H. Thompson, Hastings	4 23	315·8	365	7,696·0	406·44
Collingwood's Choicest	Estate of F. E. Hellyer, Dunedin	4 94	322·9	324	7,691·7	380·21
<i>Mature.</i>						
Sylvanus Silverlocks II	Geo. Buchanan, Paeroa	10-11 years	350·0	363	7,993·3	396·54
Creamy Lass ..	Geo. Buchanan, Paeroa	6 168	350·0	334	6,779·2	355·00
FRIESIANS.						
<i>Junior Two-year-old.</i>						
Cluny Pietje Kate V	Cluny Friesian Farm, Wellington	1 154	240·5	365	9,869·2	379·98
Cluny Netherland Colantha VIII	Cluny Friesian Farm, Wellington	1 187	240·5	365	8,393·8	309·58
Rosevale Sylvia Keyes	H. North and Sons, Omimi	1 226	240·5	196	8,377·7	264·63
<i>Senior Two-year-old.</i>						
Oakwood Daisy Bell	W. D. Hunt, Invercargill	2 341	274·6	365	13,255·1	496·12
Cluny Pietje Kate IV	Cluny Friesian Farm, Wellington	2 273	267·8	365	8,634·2	328·64
Riverlea Duchess ..	C. H. Steadman, Wai-kiakia	2 342	274·7	365	9,105·8	304·01

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

FRIESIANS—continued.						
		Yrs.dys.	lb.		lb.	lb.
Junior Three-year-old. Colantha Lass of Groteholm	R. M. Tajaroa, Taumutu	3 44	281·4	365	14,825·0	548·73
Monavale Madeline Paxton	C. C. Buckland, late of Cambridge	3 155	292·5	255	14,040·5	533·15
Riverdale Cherry Blossom	S. Clements, Hamilton	3 106	287·1	365	10,561·2	364·73
Senior Three-year-old. Cluny Hope II ..	Cluny Friesian Farm, Wellington	3 282	305·2	364	8,390·5	306·14
Mature. Mutual Pearl of Rock Countess of Leith ..	W. Barton, Featherston	7 11	350·0	365	25,648·2	903·44
	W. D. Hunt, Invercargill	6 88	350·0	365	16,571·9	589·51
Buttercup of Kokatau	Cluny Friesian Farm, Wellington	8 101	350·0	305	12,243·6	416·67

SECOND-CLASS CERTIFICATES.

Following are the records of five cows, which are the first to qualify for second-class certificates of record under the extension of the C.O.R. system brought into force at the beginning of this year:—

Name and Class of Cow.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS.						
<i>Junior Two-year-old.</i>		Yrs.dys.	lb.		lb.	lb.
Milady	H. C. Sampson, Hillsborough	1 350	240·5	364	7,209·5	388·67
<i>Senior Two-year-old.</i>						
Frisky Irene ..	James Hunter, New Lynn	2 316	272·1	365	7,174·7	420·97
<i>Three-year-old.</i>						
Rose's Speck ..	D. P. F. Malone, Riverlea	3 269	303·9	365	10,047·2	598·10
<i>Mature.</i>						
Lady Peggy ..	E. Griffiths, New Plymouth	6 69	350·0	365	11,261·0	736·98

MILKING SHORTHORNS.

<i>Mature.</i> Pine Farm Sarah ..	J. H. Parkinson, Opotiki	*	350·0	365	10,999·1	481·84
--------------------------------------	--------------------------	---	-------	-----	----------	--------

* Mature.

The *Journal* completed the first ten years of its existence with the May issue, the first number having been published in June, 1910. Seven months were included in Volume I, and the twentieth half-yearly volume closed with last month's issue.

WORK FOR THE COMING MONTH.

THE ORCHARD.

THE word "organization" as applied to the fruit industry of the Dominion is, unfortunately, owing to its use in season and out of season, beginning to lose some thing of its real force and meaning so far as quite a number of our fruitgrowers are concerned. The word "unfortunately" is advisedly used in consideration of the fact that organization must become still more familiar with the fruitgrower, not as a word alone but as an operative fact, before the industry can be raised to that position when it can be relied upon to meet and overcome the many difficulties which it has yet to face.

It is realized, however, that growers in several instances have had cause to regret the part they have been called upon to play in previous attempts at organization. That early disappointments in this direction have been the lot of other countries no doubt provides scant consolation, but this fact, together with our successes, should be taken into account when considering our failures. That we have met with considerable success in our organization work cannot be denied, and, although no scheme is yet universal in its operations, the fruit industry would have been in a very much worse state than it is to-day had those successes not been attained.

Recent events which have taken place in Wellington, in the form of sundry conferences, suggest that those most prominent in the industry are anxious to safeguard the future by evolving a system of distribution and marketing which will be more general in its effect than anything applying to the past. What the outcome of the whole of this will be, or what system, if any, will eventuate, time alone will tell; but in the future interests of the industry if proposals are submitted they should at least receive the careful and unprejudiced consideration of every fruitgrower before he decides to withhold his support.

In the meantime the orchard requires attention. The dormant season marks the opening of the year's operations, and, although the crop will not be harvested for many months, the care and attention bestowed on the orchard throughout the season has its effect on the quality of the fruit produced. This, again, has a very decided effect upon the commercial side of the industry, for no marketing system can be expected to return the fullest satisfaction unless it is supported by high-grade fruit properly prepared and packed for sale.

—J. A. Campbell, Assistant Director of the Horticulture Division.

AUCKLAND.

The fine weather which usually prevails at intervals during August provides favourable opportunities for the successful carrying-out of orchard planting, which is best completed early in the month. Stone-fruits should receive the earliest attention, owing to their coming first into bud and consequently into root-action.

All winter spraying should be completed without delay, and all prunings duly picked up and destroyed by burning. When the July oil sprayings for the control of scales, spider, and aphid have been deferred August will afford further opportunities of applying this all-important spray to pip-fruits; but the spray will have to be slightly reduced, and growers are advised to use 1-12 to 1-14 so long as no bud-movement is noticeable. The spraying of stone-fruits for the control of fungoid diseases should be thoroughly carried out with bordeaux, 8-6-40, or copper sulphate, 1-16, just when the buds begin to swell. All newly planted strawberry-beds should be gone through with bordeaux, 4-4-40, to protect the plants from attack by leaf-spot.

Early spring cultivation may be commenced during the month, or as soon as the weather conditions and state of soil will permit. It is essential that both

the ploughing and cross-ploughing should be completed before the spring growth reaches its height, principally on account of the very strong growth of clovers or trefoils obtaining in northern orchards, making it otherwise a hard task to carry out successful cultivation. Many growers are expressing their intention, on account of the high cost of labour, of ploughing right up to the trees this season, so as to dispense with digging around them. This is undoubtedly a good plan under the circumstances, but in orchards where it has not hitherto been practised, and where the spread of the trees will allow of it, great care must be exercised to avoid as much as possible the disturbance of the existing root-system. The recognized orchard practice at this stage is to plough away from the trees, working the soil back as early as possible should there be danger of root-damage from dry winds, &c. Early opportunity should be taken to bring the soil into good tilth by harrow or disk as may be required, in order that the cultivator may follow unhampered in later months.

Where rabbits or hares are troublesome to young trees, wire netting, if procurable, is the surest method of protection. If this is unobtainable paint the trunk a short distance up the leaders with fresh cow-manure made liquid with bullock's blood.

It is necessary for citrus-growers to take timely warning regarding a recurrence of last season's heavy frosts. Wherever possible heaters should be put into operation in the groves where the trees are too big for protection by covering with scrim or sacking.

Scions for grafting should now be selected from vigorous healthy trees, and heeled in in friable loam.

In connection with the outbreak of fire-blight in the Auckland District, it is as well to warn orchardists at this juncture that all cankered areas in apple, pear, or quince trees should be cut away at pruning-time and destroyed by fire, always remembering that after each cut the pruning implements must be immersed in a disinfectant solution of formalin 1 part, water 20 parts.

—J. W. Collard, Orchard Instructor, Auckland.

HAWKE'S BAY.

Pruning should be made the first consideration, as the season is near when spraying will have to be done regardless of all other work, if clean crops are to be assured.

Planting should be done as early as possible consistent with proper soil conditions. Choose a time when the soil works freely.

Between the time pruning is finished and bud-movement pip-fruit trees should have a thorough spraying with oil; all parts of the tree should be covered, leaving no blank spaces. Recent experiments carried out in this district show that best results are obtained by delaying the application as long as possible, provided the trees are not showing signs of actual growth. Oil, 1-15, applied at this period controls sucking-insect pests other than red mite, while the best results obtainable from oil for mite-control are also secured.

Stone-fruit trees which have not been sprayed during the dormant period for scale insects should receive an application of lime-sulphur, 1-15, as early as possible. Many early-flowering varieties will soon show bud-movement. All trees should be sprayed with bordeaux, 8-6-40, as they attain the stage when the flowers burst their buds. Different varieties will require watching for the proper stage, time of application being almost equally important as the mixture used for leaf-curl and plum-pocket control.

Cross-ploughing and the turning-under of cover-crops should be done as early as soil conditions will allow. A thorough working-up of the soil early in the season will ensure a more congenial soil condition and assist early root-action.

—W. H. Rice, Orchard Instructor, Hastings.

NELSON.

The orchardist will readily perceive the importance of thorough orchard spraying in early spring. To cover the trees with a fungicide which does not allow flying spores to germinate, and to destroy insect-eggs by oily or caustic sprays, is the present method of keeping orchard-trees clean and profitable. Once these organisms get well established in an orchard it is an expensive business destroying them. It is very much easier and cheaper to anticipate the attack. For these reasons spraying should be given first consideration among orchard operations during the present and following month.

The buds of peach and nectarine trees usually commence to move about the middle of the month; apricot and plum trees are somewhat earlier. The best

local practice is to spray them just before this movement with bordeaux, 8-6-40, and about three weeks later, when they commence to blossom, with bordeaux, 6-4-50. This is an effective preventive of shot-hole, plum-pocket, and leaf-curl fungi. Should the trees be troubled with aphides or scales an application of red oil, 1-20, should closely follow the first of the above-mentioned sprays.

Similar treatment is recommended for pear-trees: they commence to break their buds about the end of August, when varieties subject to black-spot more especially should receive the above spraying treatment. Pear-trees affected with pear-mite and scales should have the first application of bordeaux, followed by red oil, 1-15, while the trees are still dormant. The commencement of apple-tree spraying is best deferred till the month of September.

Orchard pruning should be pushed along at every opportunity; it is usually best to have it completed before the trees start into growth.

Orchards on the lighter alluvial lands are usually ready for ploughing during this month. Take every care to make a neat job. Follow it up quickly with two or three strokes of the harrows—on both "angles" as well as on the "straight."

This is an excellent opportunity to lime or manure the land. Make the application after ploughing, covering the whole area of the orchard, and harrow it in. Many heavy-bearing orchards require this attention.

The fruit-store continues to take up a good deal of time and attention. Considerable losses have been made in the past by overcarrying the summer and autumn varieties. These should now be about quitted, leaving only the late sorts of apples and pears in the store. —*W. C. Hyde, Orchard Instructor, Nelson.*

MOTUEKA.

Preparations should be made this month for the control of insect pests. Now is the best time to cope with San Jose scale, mussel scale, mealy bug, and red mite. Red-oil emulsion should be applied immediately at a strength of 1 in 8 to 1 in 10. This spray should not be neglected, as it will be found most effective.

Prunings should be gathered and burned, and the residue used for manurial purposes.

Planting may be carried out now. Care should be taken to procure the best stock available in the shape of strong, well-grown trees—yearling rods for preference. Trim the roots well back before planting, and remove all broken portions. Head back rods to about 15 in. high when planted. Two-year-old trees should be pruned hard back on planting to about 3 in. or 4 in. on three well-selected, evenly spaced branches. If three branches are not available without the third being a weak, spindly growth, it will be found better to leave two good branches only. However, if this can be avoided always try to maintain three forks for the foundation of the future tree.

Keep a careful watch on fruit in store, and market same judiciously, with due respect to market conditions and the keeping-quality of the fruit respectively. There is likely to be so much wastage by keeping fruit too long that the late higher prices will not compensate the loss. Watch especially for bitter-pit development in Sturmers. —*W. T. Goodwin, Orchard Instructor, Motueka.*

CANTERBURY.

By the time these notes appear all pruning operations should be finished. Collect and burn all prunings, thus destroying a possible source of infection.

Planting of new trees, whether as an extension to the orchard or replacing unsatisfactory trees, should be completed as early as possible. Get the best trees possible, and take care in planting, as much of the future welfare of the trees depends upon this operation.

Spraying is by far the most important operation during this season. Again the attention of growers must be drawn to thoroughness, which is one of the key-notes of success. Use plenty of force and cover the whole of the tree. Stone-fruits previously attacked by leaf-curl, shot-hole, &c., should receive a good application of bordeaux, 8-6-40, as soon as bud-movement is noticeable, followed by another application at strength 6-4-50 when the blossom begins to show pink. If good lime is not procurable soda may be substituted. These same sprays may also be applied to pears for the control of black-spot. In the control of woolly aphis and red mite on pip-fruits red-oil spraying may be delayed as long as possible until distinct bud-movement is noticeable, when a thorough application at strength 1-15 to 1-17 may be made.

Spring cultivation can be carried on during the month where the soil is in a suitable condition, otherwise it is better left for a time. If the orchard is

being ploughed it is as well to break down the ploughing by means of the harrows or cultivator as soon as possible.

—G. Stratford, Orchard Instructor, Christchurch.

OTAGO.

August will see the pruning operations well in hand and spray-pumps in operation. Before starting this work see that the pump and hoses, &c., are in good condition, and also cleanse the barrel well with hot water, soap, and soda. Failures to get a good oil mixture are sometimes due to lack of cleanliness in this respect.

Insect pests must be treated during the dormant period of the trees if the best results are to be secured. At this time all parts of the trees can be got at, diseases can be seen, and those trees worst affected can receive special attention. Oil sprays are still supreme against insect pests, and experience by experiments and orchard practice has fully demonstrated the fact that the stronger the mixture the better the results obtained. Unfortunately, no one application of spray will keep trees clean all the year, however well applied. For woolly aphids, scales, red mite, and pear-mite on apple and pear trees, oil sprays can be used at from 1-8 to 1-12, according to the condition of the trees and the temperature of the mixture and weather at the time of application. Late spraying with the weaker solution will often, with warm days, give as good results as the strong solutions applied in cold weather. Woolly aphid is by far the worst pest in Central Otago, and should receive more attention in the late autumn. An oil spray should be applied at this time. Spray pear-trees earlier than apple-trees, as the buds are more porous than apple-buds and more liable to injury.

Stone-fruits must be sprayed during August for red mite, green and black aphid, and San Jose scale where these are present, using oil sprays at 1-15. Peach-curl must also be sprayed for early in September. Applications of bordeaux, 8-6-40, or pure bluestone solution, 1-16, can be applied. On varieties very subject to leaf-curl a second application of bordeaux, 4-4-40, can be applied when the buds begin to show pink. Plums, nectarines, and apricots must also receive 8-6-40 bordeaux early in August for plum-pocket, leaf-curl, and shot-hole fungus.

On stone-fruits where it is necessary to spray for both insect and fungus pests bordeaux or pure bluestone solutions can be followed by oil as soon as the trees dry. If the oiling is done first sufficient time must elapse to allow the oil to disappear so that the fungicide will stick and do its work.

During the pruning select scions for re-grafting unsuitable varieties, and place them in a damp sheltered spot, or place in a box and lightly cover with sand. Top off the trees to be grafted well above the necessary height required, when new cuts can be made at time of grafting. Where the old stocks are bad with woolly aphid cut off all knots, and paint with red-oil emulsion, 1-1, to ensure a clean start for the new wood.

Quite a lot of fruit is still on hand in ordinary storage, and commencing to shrivel. Growers will be well advised not to hold on to apples too long, as fruit showing signs of wilting will not compete successfully with good cool-stored fruit, which will now be unloading on to the market. Fairly large quantities of cool-store fruit will be available this season.

—J. H. Thorp, Orchard Instructor, Dunedin.

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

AUGUST may generally be considered one of the best periods for hatching out chickens, and particularly those of the heavier breeds. It therefore ranks as one of the most important periods in the poultry-keeper's annual operations. Unless he is able to hatch and raise sufficient pullets to replace his old stock next year his profits will be seriously reduced.

It is well to reiterate that, if only profitable stock are to be reared, the greatest care should be exercised in selecting eggs for hatching purposes. A mistake often made in this connection, and particularly by many of the farming community, is to gather eggs for hatching indiscriminately from a large flock of hens. To build up or maintain a heavy-laying flock it is imperative to have a

breeding-pen, so that only eggs from those birds possessing undoubted laying-qualities and constitutional vigour are used for reproductive purposes.

The work of hatching chickens by artificial means is usually a simple matter, provided the incubator is of a reliable make and is handled in an intelligent manner. There are now so many different makes of incubators on the market, and so many systems of applying the necessary temperature, ventilation, and moisture, that it is impossible to here give any hard-and-fast instructions that will apply to all machines alike. This being so, the only safe course is for the novice to follow the instructions given by the maker of the particular machine he is using. As a general rule, if the air-cell dries down in accordance with the diagram supplied with the usual book of directions it may be taken for granted that the desired ventilation and moisture are being obtained.

There are other rules which may be applied to all kinds of incubators the observance of which is essential to success. The most important is the maintenance of an even temperature—about 102° F. for the first week, 103° for the second and third week, and 104° when hatching. Remember that when the correct degree of heat is spoken of it means the temperature required by the germ of the egg, which is always floating uppermost irrespective of the position in which the egg is resting on the tray of the incubator. The necessity of having the bulb of the thermometer resting on the top of a fertile egg will therefore be seen. The lamp should be filled every day. Do not turn the flame up high enough to smoke, or soot will collect in the flue. Trim the wick daily by rubbing with a piece of cloth, care being taken to press the corners down, so that the flame will have a round appearance. Renew the wick after each hatch. Keep the burner clean, and wipe from the lamp any overflow of kerosene.

The eggs should be turned every twelve hours, commencing on the third day. Move them gently, especially for the first week, to prevent injury to the embryo. It is not necessary that an exact half-turn should be given; a few extra rolls will do more good than harm. Cease turning the eggs just before they commence to pip. Cool the eggs after they have been in the machine for three days. As a general rule ten minutes once a day for the first week is sufficient. The time may be increased by degrees up to twenty minutes in the second week, and a few minutes longer during the third week.

In working an incubator the greatest care should be taken to see that the connecting-rod between the thermostat and the arm carrying the disk is absolutely straight, otherwise the apparatus will not work with the necessary exactness. Once the screw part of a connecting-rod becomes bent it can never be depended upon, and the only safe course is to take it out and put a new one in its place.

THE APIARY.

G. V. WESTBROOKE, Apiary Instructor.

PREPARATIONS FOR THE SEASON.

ALL necessary supplies for the coming season should now be in hand. Extra hives, covers, and bottom-boards should be made up and painted. Those who have not yet procured their material should not delay, but secure it at once.

Frames may now be nailed up and wired ready for the sheets of foundation. It is not advisable to insert the foundation in the frames much before they are required for use, as it is apt to become brittle and break down. A plentiful supply of foundation-wax and spare frames is, however, absolutely necessary to ensure success.

In putting frames together, lay the top bar groove-side up on the bench, then insert in it the end pieces, after which the bottom bar should be nailed on the ends, then reverse the frame and nail on the top bar. A 1½ in. cement-coated nail is best for the top bar, and 1 in. nails for the bottoms. Some beekeepers prefer to nail the top bar from the end pieces, but this is a matter for individual taste. If the 1½ in. nails are driven straight down through the top bar into the end bars, one will be found sufficient for each end, making a good strong job and economizing nails.

When the frames are made up they may then be wired. In America the question of the number of wires necessary and the method of wiring in order to prevent the combs sagging has been much discussed of late. In New Zealand, however, it has generally been found that three horizontal wires are sufficient,

and there seems to be little trouble with the combs stretching or sagging, as seems to be the case in America when but three horizontal wires are used. Therefore the beginner would do well to adopt the usual New Zealand method of wiring, the frames supplied by the manufacturers being provided with three holes in each end bar for the purpose.

The simplest method of wiring is to lay the frame on the bench, drive a small tack in the edge of the right-hand end bar near the top hole, and another tack in the other end bar opposite the bottom hole, taking care not to drive them right home. Thread the wire through the top holes down and through the centre ones, and from there through the bottom holes, then wind the end of the wire around the bottom tack and drive it home. Now tighten the wires, wind round the top tack, and drive it home likewise. Make a loop in the wire near the tack, and it can be easily broken by tightening the loop, or else have an old pair of scissors to cut the wire.

EARLY SPRING WORK.

Advantage should be taken of nice warm days to examine the hives, but care should be taken not to leave the hive open too long, as there is danger of starting robbing in the apiary. The principal object in the examination should be to ascertain if the bees have sufficient stores to carry them on until the regular spring flow is on. This is the most critical time of the year for the bees in regard to the risk of starvation, as when brood-rearing commences large quantities of honey are consumed. The beekeeper should therefore see that there is an ample supply in each hive, and, if not, it will be necessary to resort to feeding. In spring feeding use 2 parts of water to 1 part of sugar, feeding always inside the hive.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

ASPARAGUS: Stable manure should wherever possible be the chief fertilizer employed with asparagus, as it is not only a fertilizer that is nearly complete, but the residue of humus that is left keeps the soil open and covers the crowns, which tend to rise in the ground, partly because this is a natural habit, and also because of the settlement of the soil. A useful addition is to mix a 6-in.-potful of bonedust with a barrow-load of fresh wood-ashes, and apply the mixture in a dressing about 1 in. deep. Cow-manure should not be used except on very light or sandy soil. If loamy soil is treated with this manure it becomes very sticky while the wet weather lasts, and very hard when dry. Sheep-droppings are usually full of grass-seeds, and can hardly be used as a surface-dressing until most of the seeds have germinated, by which time the manure is not likely to be very valuable except as humus, and should be supplemented with blood-and-bone or a similar fertilizer. Salt was formerly considered indispensable in asparagus-culture; it is not now so regarded, and may be dispensed with as a fertilizer. Salt is, however, useful for destroying weeds, which are not at times easily disposed of by other means, as the character of the plants does not allow deep digging. In such case 4 oz. per square yard may be given; it will also dispose of slugs and other soil pests.

Nitrate of soda is the most active nitrogenous fertilizer, its effect being to force growth. Being quickly leached from the soil by rain, it should be applied only to growing plants, and then only in small doses. Three-quarters of an ounce per square yard is as much as should be given at one time, repeating it in five or six weeks, the two dressings being in most cases sufficient for the season. This amount should be applied to asparagus-beds when growth begins. Cabbages and cauliflowers recently planted should have a similar application as soon as they begin to grow. In this case spread it near the plants: it is soon washed in by rain, but it is as well to scratch it in with a rake; it should not be dug in. The statement is often met with that nitrate of soda should not be given to peas. This statement is right only in some circumstances, the fact that these plants gather nitrogen from the air does not in all cases make them independent of it if given artificially. If plenty of stable manure in a not-too-rotten condition is dug in they do not need it. It is commonly thought that if a leguminous crop is dug in it will supply all the nitrogen required. It may, however, not be

generally known that during the process of decomposition gases are generated that render the soil acid, and that nitrogen bacteria are thereby rendered inactive, so that for a time there is a total absence of available nitrogen in the soil. I have found peas to be greatly benefited by nitrate of soda applied to soil where a crop of lupins had been recently dug in.

Peas: To maintain a continual supply it is necessary to sow about every fortnight. The best plan is to sow again when those last sown are all through the ground; this saves bothering with dates.

Cabbages and cauliflowers: These should have been planted a month ago wherever the soil and climate would allow it to be done, and no time should now be lost in getting them out. The same remarks apply to lettuce, with the addition that seed also should be sown at once.

Onions: Transplanting should be gone on with as advised last month. Seed should be got in wherever possible. The best onions are grown on sandy loam, on which class of soil, other things being suitable, the bulbs finish with a fine, bright, silky skin, though they can be successfully grown on almost any soil. Clay soils give most trouble, yet if the autumn is not overwet such land will produce fine bulbs. The important points in culture are to secure a clean and firm surface to start with, to keep weeds down by cultivation, and to refrain from giving exciting fertilizers late in the season. Nitrate of soda may be given immediately after thinning seedlings, or, in the case of transplanting, as soon as the plants begin to grow, and again in each case five or six weeks later. The object is to set up vigorous growth in the young plants. If the soil is rich they may grow strong enough without the nitrate, in which case it should not be given; its purpose is to supply a deficiency, and it is not indispensable in every case. It is a mistake to excite growth when the bulbs are well formed; it would most likely result in soft, rough-skinned specimens. On clayey land onions are a rather expensive crop to grow, and it would not be wise to undertake it on a large scale. Where the soil is kindly every stage of the work is easy, and in such circumstances every settler should grow as many as he can reasonably attend to. For long keeping it is usual to grow such varieties as Brown Spanish, Brown Globe, and James's Keeping, and these are in general best for the purpose. Where conditions are specially favourable most varieties finish with long-keeping qualities. Medium-sized bulbs are in greatest demand for market purposes; bulbs weighing between 3 oz. and 4 oz. usually command a higher price than those of larger size; also, when grown for home use the smaller bulbs are most generally useful. To obtain bulbs of medium size thinnings should not be too severe, and the plants need not stand in single file. This is largely ruled by the quality of the soil. I have seen crops where the bulbs actually overlapped each other, and were all good. For boiling whole, large bulbs are best, causing a saving of labour in preparation, and being milder in flavour. The largest bulbs are grown by transplanting from autumn seeding. Fairly large bulbs of good quality can be got by sowing the right kinds in spring. Mammoth Silver King is good for this purpose. White Queen is the quickest to bulb; good-sized bulbs can be got early in the New Year; they are not keepers, but a small breadth is useful. Tree-onions are interesting subjects to grow, and look well in the garden; they throw up a seed-stem which produces a bunch of small bulbs instead of seeds; these bulbs are useful for pickling. The small bulbs should be merely pressed into the ground so as to just cover the crown. Set them in rows 12 in. or 15 in. apart, and 10 in. between the sets.

Shallots and garlic: If not already planted, these should be got in at once, the method being the same as for tree-onions. Both are used for sauce-making and chutney, and shallots are excellent pickled.

Carrots: Sow a small bed of a short-horn variety to last till the main crop is sown. Two sowings are sufficient for the season. The lines of the first sowing should not be severely thinned; if each plant stands singly that is sufficient, however close they may be. When they are no thicker than a lead-pencil the first may be drawn for use. By constantly drawing them from different parts of the bed thinning is gradually done. By this plan a vast amount of produce is taken—a larger amount than any other crop will give—and the flavour of the young roots is the best.

Turnips: These may be sown early in August. Extra Early Milan comes quickest, but I prefer Snowball, which takes very little longer. Sow only a small bed, as turnips do not stand long during warm weather. Very little thinning is necessary if the bulbs as they are ready are drawn from different parts of the bed. By exercising care in this respect the most is made of space and a great saving effected.

Radishes: These should now be sown regularly. The short varieties such as the turnip-rooted, French Breakfast, &c., are best for early sowing; the long varieties are best for hot weather. A small sowing should be made every ten or twelve days, so as to have them fresh and crisp.

Red Beet: If this salad is required during summer sow a small bed with a turnip-rooted variety. The true role for red beet is, however, as a winter salad, when tomatoes and other summer vegetables are past. The long varieties are best for winter; they should not be sown yet.

Rhubarb: The summer variety should be planted now. Set the clumps 30 in. apart in rows a yard apart, and plant deep enough to just cover the crowns. No produce should be taken in the season of planting; all the plants' energies should go to make crowns; a good crop may then be expected the following season. Established beds should be cleaned up and the soil turned over. Stable or other animal manure should not be turned into the ground; it holds water, makes the soil cold, and delays the crop. This is a point worth noticing by market growers, as the earlier the produce is marketed the better the price. Stable manure is almost a necessity to successful rhubarb-culture, but it should be given later as a top-dressing, so that the soil may not contain a lot of water-holding humus in spring.

Tomatoes: Seed may be sown during the last half of August. It is bad policy to sow earlier, except in places where there is no frost. In most places it is not safe to plant till early in November, and it is best not to keep the plants too long in the boxes. In the colder districts it may be necessary to raise the seedlings in heat. This should, however, be avoided wherever possible, and where it cannot be avoided the heat should be very mild. Experience shows that raising the seedlings on hotbeds is a plan to be avoided. The rank moisture from the manure may cause curled leaves, making the plants look sickly, and there is great danger of their getting weak and leggy before they can be pricked off. A much better plan is to raise the seedlings without heat, prick off as soon as they can be handled, and place the boxes on a mild hotbed covered by a frame in the open air, where as soon as they begin to grow they can be freely ventilated. In most cases, however, artificial heat is not required.

Early potatoes may be planted where frosts do not occur. Sprouted whole sets about the size of a hen's egg are best.

LAND FOR RETURNED SOLDIERS.

DURING the month of June an area of 101,448 acres, subdivided into 132 holdings, was thrown open for selection. Practically the whole of this area was available for selection by discharged soldiers only. One pastoral run of 21,200 acres and six small grazing-runs aggregating 34,750 acres are included in the total area. The balance of the land was suitable for mixed farming, dairying, &c., and was subdivided into 125 holdings.

An area of 18,028 acres is advertised as being available for selection during July. With the exception of some six sections of bush land in the Auckland District and four small sections in the Marlborough District the whole of this area is available for discharged soldiers only, and is subdivided into 39 holdings.

During August an area of some 17,000 acres of Crown lands situated in the vicinity of Otago is to be opened for selection, together with numerous other areas of Crown and settlement land scattered throughout the Dominion.

Honey-grading.—The regulations under the Apiaries Amendment Act, 1913, appointing, *inter alia*, specified ports from which alone honey may be exported, have been amended by the substitution of Wanganui for Waitara.

Wheat and Oats Threshings.—Returns of actual threshings received by the Government Statistician up to 16th June from threshing-mill owners show that till that date 4,122,132 bushels of wheat and 5,764,096 bushels of oats had been threshed out. The average yields per acre in cases where particulars of area were furnished (covering 97 per cent. of total threshings) worked out at 34.40 bushels for wheat and 41.45 bushels for oats. The wheat average for Canterbury was 34.57 bushels, and for Otago 33.52 bushels.

REVIEWS AND NOTICES.

THE DOMINION OF NEW ZEALAND UTILITY-POULTRY STANDARDS:

CONTAINING A COMPLETE DESCRIPTION OF THE MOST POPULAR BREEDS OF UTILITY POULTRY, AS APPROVED BY THE NEW ZEALAND DEPARTMENT OF AGRICULTURE, THE NEW ZEALAND POULTRY ASSOCIATION, THE NORTH ISLAND POULTRY ASSOCIATION, THE SOUTH ISLAND POULTRY ASSOCIATION, AND THE NEW ZEALAND POULTRY CHAMPIONSHIP ASSOCIATION.—Published by the Department of Agriculture. First Edition, 1920. Government Printer, Wellington.

For many years there has been a strong diversity of opinion between fanciers and utility breeders of feathered stock as to the standards that should be adopted for judging utility fowls at poultry shows. It is now most gratifying to note that a more common ground of agreement in this respect has been arrived at between the two parties. This was brought about as a result of a conference held at Christchurch in February, 1918, of delegates representing the various associations concerned in the show movement, together with the Poultry Instructors of the Department of Agriculture. At this meeting a new series of standards was framed and unanimously agreed upon. By request, the work of preparing the necessary type illustrations of the various useful breeds of poultry dealt with, and that of publishing the complete work, was undertaken by the Department. In this connection mention may be made of the services of Mr. G. Nordstrum, of the Government Printing Office staff, who most capably carried out the artist work for the illustrations of ideal specimens of the respective breeds.

The main object aimed at in the text of the standards compiled by the conference, and in the accompanying diagrams, is to combine beauty—or, in other words, breed characteristics—with the maximum points indicative of laying-capacity and constitutional vigour. The standards therefore serve a dual purpose: firstly, as an ideal to aim for by those who enter birds in utility classes at shows, and, secondly, as a guide to mating and culling stock by those who keep poultry for profit. One of the greatest mistakes made in the past was to assume that because a bird was built on utility lines it could not be a good specimen of the breed it represented. In view of the fanciers and utility breeders having now come to a clearer understanding that poultry can possess the maximum of utility qualities and yet be desirable types of their respective breeds, it is to be hoped that in the near future the poultry shows will come into line with the shows of other classes of live-stock, whereby the adoption of the principle of one type and one judging standard for each breed will be strictly adhered to. The present system of separate classes for fancy and utility stock makes neither for the advancement of poultry shows nor the poultry industry generally. The tendency towards favouring in the one class specimens which have merely some extreme show points to recommend them, and in the other class birds probably possessing some laying-points but which are lacking in size and breed type, should be severely checked. From an industry viewpoint both classes of birds are undesirable. Therefore, why not eliminate from the show schedule both fancy and utility, and let the exhibition of fowls be looked upon as a purebred-poultry show? The ideal bird for the show-pen is one pure in every sense of the word, without being of exaggerated type of the breed it represents. There must also be a happy combination of standard requirements with points indicative of laying-power and strong constitutional vigour. The text and plates in connection with the various breeds of poultry now published in this first edition of the Dominion of New Zealand Utility-poultry Standards aim at the ideal sought for. If these have the right interpretation placed on them, there is really nothing to prevent any of the useful breeds of purebred poultry being judged by this one standard of excellence, under which breed-type and usefulness will be combined.

F. C. B.

NOTE.—The main sale of the "Standards" has been undertaken by the New Zealand Poultry Association. Applications should be addressed to the Secretary of that organization, P.O. Box 588, Christchurch. The price of the work (bound in semi-limp cloth) is 3s. including postage.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

GOAT'S-RUE AND LIVE-STOCK.

"SUBSCRIBER," Palmerston North :—

Is goat's-rue detrimental to stock? I have had two ewes die lately in a very much blown condition, the stomachs seeming to contain a great deal of this plant. Sheep have been amongst it all along with no bad results, but a fresh draft was put on, and the trouble occurred in this lot. Has the plant the same deadly effect on cattle?

The Live-stock Division :—

The evidence so far produced as to goat's-rue being detrimental to stock is very contradictory and unsatisfactory. The Department conducted feeding-experiments twelve months ago. Stock ate it sparingly, and an infusion made from the plants was given as a drench. The animals at the conclusion of the experiments were uninjured, though they had lost condition. A farm in the Woodville district has been practically cleared of the weed by stock. The practice was to cut down the plants a few inches from the ground at the end of winter, and then turn stock into the paddocks. The weed had a good feeding-value, and no ill effects were noticed either in sheep or cattle depastured on it. Ensilage was made entirely from goat's-rue on Mr. A. Buchanan's Ashhurst property in January, 1916, and was fed to stock in August of the same year. The stock ate it readily and did well on it. Moussu and Desaint, in France, reported the deaths of a number of sheep due to eating goat's-rue, and later experiments proved that 10 lb. of the green leaf was sufficient to poison a sheep. There is no direct evidence that the plant in question has caused the death of stock in this country. Your ewes apparently died from the result of excessive fermentation brought about by gorging themselves with the plant.

ERADICATING WILD OATS ON WHEAT LAND.

M. S., Canterbury :—

Will you kindly give some information as to how to clear wheat land of wild oats?

The Fields Instruction Branch :—

To eradicate wild oats the land should be ploughed shallow or disked immediately after an infested crop is harvested, the best method being for the disk to follow behind the binder. The purpose of this is to cover the seeds of wild oats. Some of them will germinate in the autumn, the remainder will start in the spring. As soon as plants appear in the spring the ground should be ploughed shallow to destroy them and to start another growth. This should be followed in about two weeks' time by deep ploughing to bring up the seeds lying at a greater depth. Harrow after each ploughing to start growth. During the remainder of the summer wild oats should be kept down by the use of the disk or broad-shared cultivator. The next season stray plants should be hand-pulled, or, if they are still thick in a few spots, they should be cut and burned. Instead of continuing the summer fallow, sow in November, after the second ploughing, a crop of green feed. This crop, however, must be cut or fed off before any of the wild-oat seeds approach maturity. Seed is often allowed to ripen on the edges of the paddocks and fence-corners, and thus the object of much work is defeated. Finally, care should always be taken to sow clean seed-grain in cropping.

PROPAGATION OF THE SCARLET FLOWERING GUM.

"DIGGER," Waitara :—

Would you please advise me as to the best method of propagating the scarlet flowering gum.

The Horticulture Division :—

Although it is possible for experts with the proper means to raise this tree by cuttings, the usual method of propagation is by seeds, and this is the only method possible for you. The plants do not transplant well, therefore they should be raised in pots. Three-inch pots should be used; fill these pots with a light sandy compost, and place two or three seeds in each pot. If more than one plant comes, remove all but the strongest. Transplant to the open ground when the roots have run freely through the soil and before the plants become root-bound. A glass-house is not necessary for raising the seeds, but the pots should be protected from bad weather. A sheet of glass placed over them will answer the purpose.

CHEMICAL TREATMENT OF TREE-STUMPS.

"SUBSCRIBER," Otorohanga :—

In the April issue of the *Journal*, when dealing with tree-stumps, you advise boring holes 6 in. deep and plugging them with potassium nitrate. I am not clear whether the holes should be plugged to keep out the weather after being filled with potassium nitrate or left open.

The Fields Instruction Branch :—

In addition to plugging the holes with potassium nitrate (which can be purchased in Auckland at £3 15s. per cwt., or 9d. per pound for 56 lb. lots, or lesser amounts at 11d. per pound), plug loosely with earth to prevent washing by rain. If the stumps are solid increase the number of holes in accordance; and we would also advise leaving them for a longer period than previously mentioned before firing—say, till the end of winter.

CONVERTING A PASPALUM AREA.

P. A. GRACE, Tokaanu :—

What is the best way of getting rid of paspalum growing thickly in a 10-acre paddock of good river-silt, or what would be the best way of cropping it for pigs for the first few years?

The Fields Instruction Branch :—

The land you mention being of a high-class character, it is suggested that you give it as thorough a cultivation as possible. Then partially fallow for at least three seasons. During intervals the area may be sown in plots of 2 acres each with Early Leaming maize, Broad-leaved Essex rape, artichokes, Blue Imperial peas, and horse-beans. The pigs may be turned on to these several breaks in rotation. Continue this until successful progress has been made, when the land should be suitable for laying down to permanent pasture.

FRUITING OF QUINCE-TREES.

A. NICOL, Tiakitahuna :—

I have a quince-tree which promises an abundant crop each year. The fruit, however, never reaches maturity, but drops off when about the size of a hen's egg. The tree is four years old and is perfectly healthy and vigorous. Can you tell me the cause of this trouble?

The Horticulture Division :—

It is surmised that in this case the cause is unsuitable soil. The quince is reputed to thrive only on extra moist soil. This is not correct, but it will not thrive in very dry soil. A fairly deep, well-drained soil of good average quality is necessary for successful culture. It is not uncommon for many of the fruits to fall under stress of dry weather. This falling may be only sufficient to effect

a reasonable reduction in numbers, and in such cases results in a crop of good fruit. If, however, the soil is shallow and very dry the whole crop may be lost. Varieties also show varying resistance to drought. The large-fruited varieties suffer most. The variety known as Van Diemen is the most reliable cropper, and succeeds admirably where others fail.

PRESERVING BUTTER.

Mrs. J. ARCHBOLD, Avondale :—

Will you kindly let me know how much boracic per pound is required to keep butter for three months, for home use.

The Dairy Division :—

We do not recommend the use of boracic acid for the preservation of butter. If the butter is properly made from cream which has been handled in vessels which have been kept thoroughly clean and scalded with boiling water, and the same principle followed in respect to the milk from which the cream is skimmed, the addition of $\frac{1}{2}$ oz. to $\frac{3}{4}$ oz. of salt to each pound of butter should be sufficient to ensure the butter retaining its keeping-quality for a reasonable length of time. It may be mentioned, however, that butter-preservatives which consist largely of boracic acid are frequently used to the extent of 35 grains to each pound of butter.

INDIGESTION IN HORSE.

“COCKY,” Karamea :—

I have a draught horse which though fed on chaffed hay and oats, with a run on grass when not working, remains in very poor condition. He seems to pass far too much dung and has a very offensive odour. Can you recommend any treatment for him?

The Live-stock Division :—

Your horse is probably suffering from a form of indigestion. This may result from bolting of the food, due to defects in the back teeth. Examine the horse's mouth, and have the back teeth filed to remove any sharp edges, which may prevent proper mastication. Give a drench consisting of one pint of linseed-oil containing 1 oz. of turpentine. Afterwards try the following powders (which any chemist will dispense for you) once daily for a week, mixed in the feed: Hyposulphite of soda $\frac{1}{2}$ oz., powdered ginger 2 drams, powdered gentian $\frac{1}{2}$ oz. Keep the horse supplied with rock salt to lick. The possibility of the condition being due to internal parasites should not be overlooked.

LAMENESS IN CATTLE-DOG.

H. BURTENSHAW, Bluff :—

I have a cattle-dog which has gone lame, apparently on account of soreness in the pads. The skin between the pads is also red, and the inflammation appears to be extending up the legs to the body, the hair falling out on the affected parts. It looks like mange or gout. The dog works for about two hours daily on very rough country. Would you kindly advise as to treatment.

The Live-stock Division :—

No doubt the lameness is caused by the very rough country. The dog should be put off work for at least one week. A lotion consisting of methylated spirits and water, equal parts, may be applied to the feet for five minutes twice daily. The affected parts on the legs should be dressed with sulphur ointment.

Maximum Prices of Bran and Pollard.—The Order in Council of 12th April, 1920, has been amended in the Third Schedule by the substitution of £7 15s. for £7 in the case of bran, and £9 15s. for £9 in the case of pollard.

REGULATIONS FOR CONTROL OF FIRE-BLIGHT.

Two sets of regulations under the Orchard and Garden Diseases Act for the better control and eradication of fire-blight were gazetted on 18th June, 1920, as follows :—

I. PROHIBITING THE REMOVAL OF CERTAIN PLANTS, AND BEES, FROM THE AUCKLAND DISTRICT.

1. In these regulations "prescribed area" means that portion of New Zealand comprised within the North Auckland and Auckland Land Districts.

2. No plant or portion of a plant of any variety of apple, pear, quince, or crataegus shall be sent or brought from the prescribed area into any other portion of New Zealand :

Provided that nothing in this regulation shall apply to the sending by an officer of the Department of Agriculture, under proper safeguards, of plants or portions of plants of any of the above-mentioned kinds from the prescribed area for the purpose of the identification of disease.

3. (1.) Every package of trees or shrubs, or portions of trees or shrubs, sent from the prescribed area to any other portion of New Zealand must be accompanied by a certificate in the form set out in the schedule hereto, signed by the consignor, that no plant or portion of a plant of any variety of apple, pear, quince, or crataegus is contained in the package. (2.) The certificate shall be endorsed on a tag or label securely attached to the package in a prominent position.

4. No bees shall be sent or brought from the prescribed area to any other portion of New Zealand.

5. Every person who does or omits any act in contravention of these regulations commits an offence, and is liable on conviction to a fine not exceeding £20.

Schedule : Certificate to accompany Packages of Plants.

I, the undersigned, hereby certify that no plant or portion of plant of any variety of apple, pear, quince, or crataegus is contained in this package.

Place :

Signature :

Date :

Witness to Signature :

II. POWERS OF INSPECTORS, ETC.

1. In these regulations "Inspector" means an Inspector appointed under the said Act.

2. If an Inspector finds the disease known as fire-blight (*Bacillus amylovorus*) present in a nursery or orchard, or if such disease is known to exist in such proximity to a nursery or orchard as in the opinion of an Inspector to have rendered the infection of such nursery or orchard probable, the Inspector may by notice served on the occupier of such nursery or orchard prohibit the removal therefrom of any plant or portion of a plant of any variety of apple, pear, quince, or crataegus.

3. Such prohibition shall remain in force until withdrawn by notice served on the occupier of the nursery or orchard by an Inspector on being satisfied that the disease has been eradicated and that no risk of infection remains.

4. While such prohibition is in force in respect of any nursery or orchard no person shall take, remove, or send out of such nursery or orchard any plant or portion of a plant of any apple, pear, quince, or crataegus, or, knowing such prohibition to be in force, shall receive any such plant or portion of a plant as aforesaid from such nursery or orchard :

Provided that nothing herein contained shall prevent any Inspector from sending, under proper safeguards, specimens of plants out of such nursery or orchard for identification of disease.

5. Every person who does or omits any act in contravention of these regulations commits an offence, and shall be liable on conviction to a fine not exceeding £20.



The New Zealand Journal of Agriculture.

VOL. XXI.—No. 2.

WELLINGTON, 20TH AUGUST, 1920.

SOILS OF THE MANAWATU DISTRICT.

PART II. THE HUMUS SOILS.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

ORIGIN.

IN considering the humus or peaty soils of this district some space may be devoted to an attempt to understand how they have been formed. It would seem that the advance inland from the sea-coast of the wind-borne sand has resulted in the damming-back of the drainage waters from the higher levels, and the blocking-up of the creeks and watercourses at or near their mouths. This has resulted in the formation of shallow lakes, raupo swamps, sphagnum bogs, and waste areas of rush, reed, and flax. The final development into swampy forest, with the white-pine and the pukatea as the dominant forest-trees, may be assumed to be the final stage of the development as a swamp, and one which would persist for a long period. An excellent example of a swampy forest is the Round Bush at Foxton, where, surrounded by high sandhills, on an area on the sand, tall white-pine forest has developed, although the floor is completely covered with stagnant water. One can walk through the forest dryshod only by treading on the gigantic tree-roots which have raised themselves above

the soil and water—an adaptation which the many forest-trees of swamps have evolved in order that oxygen may be obtained for the roots.

Starting, therefore, with a shallow pond formed on sand, the growth and decay of aquatic plant-life soon forms a covering on the bottom. Various water-plants flourish and die, and the remains, protected from complete oxidation, accumulate. Raupo or bulrush (*Typha*), being specially adapted for growth in a submerged area, invades the water, and adds by the growth and much annual shedding of bulky dead vegetable tissue to the accumulation of organic matter. The raupo spreads throughout the ponds, its long flexible and cylindrical stem being extraordinarily well fitted to resist the pressure from wind or water currents. Gradually the pond fills up sufficiently to permit the growth of sphagnum moss, a wonderful and most useful plant, and one which deserves wider recognition and utilization in this country.* Sphagnum, owing to its spongy nature, is able to absorb large quantities of water; each plant is able to continue growing upwards while the lower portions are decaying and forming peat. It can thus enjoy a perpetual existence and flourish on the stratum which it is continuously building from the products of its decay. The sphagnum bog is now invaded by all kinds of plants capable of living in a medium fully saturated with water. Rushes, sedges, reeds, the liliaceous flax (*Phormium*), and cabbage-tree (*Cordyline australis*), manuka, heaths, and coprosma bushes—the last three being woody plants—are among those which may be found in sphagnum bogs. From a shrubbery to a forest is the last stage.

In the flax-milling industry of the Manawatu it has been found possible to hasten in large areas the natural succession of swamp into pure flax swamp, when the former has reached the stage of supporting stunted flax-plants at fairly wide distances apart. Artificial drainage results in the establishment of the optimum conditions for the growth of flax, the few stunted plants seed the area, and the whole becomes tenanted with what is practically a pure association of flax, forming at its best a dense jungle through which one can only force oneself with difficulty.

COMPOSITION.

In the organic soils now growing herbaceous plants, such as phormium, the outstanding feature in which the soil differs from others of the vicinity is the large amount of organic matter (consisting of the more or less decayed vegetable-remains) present compared with the inorganic or mineral matter (sandy or silty particles). In these flat areas liable to be flooded by the contiguous rivers the amount of

* Dried sphagnum moss was extensively used during the late war as a most efficient antiseptic and absorbent dressing for wounds. Gardeners and nurserymen use it for packing round the roots of garden-plants and young trees: the well-known property that sphagnum possesses of keeping moist to any extent desired without putrefying or becoming mouldy constitutes it an ideal material for the purpose. In the human nursery it is now becoming a fashionable packing for young babies. The Maoris may often be seen drying it in the sun for stuffing into bedding in the same way as kapok and feathers are used. Its absorbent, antiseptic, and resilient properties make it an admirable substitute for other bedding-material. Its name, or a derivative, has been used to designate various proprietary pharmaceutical articles at present imported into New Zealand and presumably made from it or its products.

mineral matter, as one might expect, varies greatly. Certain swamps or portions of them which are never flooded by river-water show remarkably high percentages of organic matter—as, for instance, those of Waikanae and Otaki. In these there is only from 15 to 30 per cent. of mineral matter. In stations where such a river as the Manawatu is able to flood and deposit large quantities of silt and fine sand on the swamps from time to time, it will be found that mineral matter may be present in the soil in amounts exceeding 80 per cent.

The nitrogen of these humus soils varies considerably; in one of the Waikanae soils the amount present was 2.85 per cent. When one considers that the quantity of nitrogen in steamed bonedust is about 3.3 per cent., it will be seen that there is a large amount of



SWAMPY FOREST ON SAND, WAIKANAÉ

Showing reed (*Gahnia*) and cabbage-tree (*Cordyline*) round margins.

[Photo, B. C. Aston.]

fixed nitrogen in these organic soils, but, unlike that of bonedust, it is only slowly available for use as plant-food. The accumulation of these deep deposits of organic matter is due to excessive moisture, absence of oxygen, and low temperature, and it is only when the land is drained and aerated that the nitrogen becomes available for pasture and ordinary crops.

As these swampy areas are often adjacent to huge sand deposits it may perhaps be possible at some future date to open up channels through the sand, enabling the wind to blow sand on to the swamp, thus cheaply transporting quantities of that very mineral matter, in a fine state of subdivision, which is required to convert the organic matter into a fertile soil. As bearing on this subject may be mentioned the translation of a French work on sand-reclamation in France ("The Fixation of the Dunes of Gascony," by E. Harlé. N.Z. Forestry Department, Wellington, 1920), in which it is shown how by human

ingenuity the forces of nature have been directed at a comparatively low cost so as to transform large areas of dangerously drifting dunes into forest or other stabilized surface. For details the work referred to should be consulted, but it may be briefly explained that by a series of palisades the sand may be directed by the force of the wind to the position in which it is required. Of course, in filling in a swamp much levelling by means of horse-power may be required, but the idea is that the wind should do a large share of the work. The addition of organic matter to sandy country has always been considered a better way of ameliorating it than by applying lime, and the application of peaty soil to sandy soil, or *vice versa*, is highly commendable when practicable.

The citric-acid and hydrochloric-acid extraction of these swampy soils yield figures for the chief mineral plant-foods, which are extremely variable, a result which is probably due to the varied history of the different areas sampled. The coastal lands have in the past doubtless undergone great changes affecting comparatively small areas at a time. Local sand-drifts may have profoundly affected some areas, either by blocking the drainage and thereby inducing swampy conditions, or by filling up swamps and making good dry land. Rivers in flood may have carried large quantities of sand, silt, and clay over peaty soils, thus ameliorating them by the admixture of mineral matter; the receding of the sea may have left salt areas or deposits of shells which have induced a different type of vegetation; and the smaller rivers have no doubt changed their courses, as has been the case with the Waikanae River, the old course of which may be plainly seen to this day. All of these courses have no doubt contributed to the variability in composition which at present exists in the soils and subsoils of the district, the lower-lying or swampy ones being especially liable to alteration. Elevation or depression of the coast area no doubt also played a part in effecting changes accentuating local differences of composition.

Generally speaking, these organic soils are rich in available and total potash when compared with others of the same class. This fertilizer ingredient one would expect to be the dominant one required by phormium as a fibre or cellulose-producing plant. Sir A. Church, from analyses of English-grown fresh leaves of flax made in 1876, estimated that 100 lb. of green flax-leaves (butts) would yield $\frac{1}{2}$ lb. of potassium carbonate. He also found that the dried leaves contain 19.2 per cent. of sugar (or 4 to 5 per cent. on the fresh leaves). Thirty tons of flax per acre every four years is considered a good average yield, although this quantity is sometimes doubled, and it takes about 8 tons of green leaves to produce one ton of fibre. All plants which elaborate in their tissues large quantities of starches, sugars, fats, or cellulose require a soil which will yield large quantities of available potash. This would be especially true of plants with a limited root-system. Phormium has a comparatively poor root-system, and if only the rooting-system could be stimulated to search for it there need be no fear of a deficiency of potash.

Phosphoric acid, the other important fertilizer constituent, is not so conspicuously plentiful, and hence one would predict that application of phosphates to these soils when properly drained would result in



TAWA AND KOHEKOHE GROWING ON ANCIENT DUNE, WAIKANAE.



LOOKING INTO HOLLOW ON SAND, WAIKANAE.

Flax and reed swamp developing into manuka scrub, and finally into forest.

[Photos, B. C. Aston.

much greater yields of crops. Stimulating the root-action by means of a solution of superphosphate, or by applying finely ground phosphate rock, might be tried as a means of combating trouble in the flax crop.

Lime is usually present in plentiful amounts, but is sometimes over-balanced by magnesia, as in the Rangitane Swamp, which suggests that the past influence of sea-water on the areas in which this excess occurs may be looked for. This excess of magnesia over the lime in the soil and subsoil of some of the worst yellow-leaf disease areas is interesting. The incidence of unbalanced lime-magnesia ratio has been noticed before in soils on which deficiency diseases develop in animals (see Annual Report of this Department for 1918-19), but not previously in diseases of plants.

In spite of there being plenty of lime present the avidity for lime shown by these humus soils, or "muck" soils, as they are called in America, is still very great, and they are able to absorb up to 1.5 per cent. of their weight of lime from a solution of bicarbonate of lime. One does not recommend, of course, the application of such huge amounts as this would involve, although a moderate liming with carbonate would do much to establish a healthy growth of grass on the well-drained soil. As an ameliorating agent for sand it cannot be too strongly urged that humus or organic matter is the very best application to make, just as for organic or peaty soils after drainage the very best treatment would be the admixture of sand containing insoluble plant-food, but which the soil water of peaty lands will speedily make soluble and available for plant-food. Another cheap method of ameliorating deep peaty soils is by controlled burning to a certain depth, as advocated in the *Journal* for July, 1917. On page 28 of the same issue Mr. A. Seifert is quoted as stating that burned areas are considered the best flax land.

NOTES ON THE SOILS ANALYSED (SEE TABLES).

H 376.—Collected (12/11/16) to depth of 15 in. in a small drained swamp behind Ngarara homestead. Swamp surrounded by sandhills. Now used as a vegetable garden. Last native vegetation manuka, flax, and raupo.

H 384.—Collected (13/11/16) in swampy forest on Waikanae sandhills. Pukatea - white-pine forest of pukatea (*Laurelia*), white-pine, tawa, kohekohe (*Dysoxylum*), swamp-maire. Underscrub of mahoe, ngaio, tutu, whauwhau (*Panax arboreum*), *Myrsine Urvillei*, lancewood, manuka (*Leptospermum scoparium*), *Pittosporum tenuifolium*, *Muehlenbeckia australis*, *Phormium tenax*, *Coprosma tenuicaulis*, *C. robusta*, *C. grandifolia*, hangehange (*Geniostoma*), *Carpodetus*, *Hedycarya*, *Olearia Cunninghamii*, *Weinmannia*, fuchsia. Lianes and Epiphytes: *Kiekie* (*Freycinetia*), *Rubus schmidelioides*, climbing ratas (*Metrosideros scandens*, *M. florida*), *Parsonsia*, and tree-ferns.

H 623.—Collected (3/3/17) in white-pine forest, about three miles from sea on the Levin Beach Road.

J 118.—Collected (28/4/17) from Rangitane flax swamp (Louis Seifert's), top 300 acres, which was at that time comparatively free from yellow-leaf disease. Taken to a depth of 9 in.

J 121.—Collected (28/4/17) from Rangitane flax swamp (L. Seifert's), bottom 300 acres, on which yellow-leaf had developed considerably, the roots having died out and the yield of flax greatly diminished. Taken to a depth of 9 in.

J 166.—Collected (12/5/17) in Brown's flax swamp, near Waikanae. No yellow-leaf developed in this portion of the swamp.

J 393.—Collected (29/9/17) in white-pine forest, Round Bush, Foxton. Forest of white-pine, pukatea, pokako (*Eleocarpus Hookerianus*), swamp-maire (*Eugenia*), rewarewa (*Knightia*). Underscrub of titoki, hangehange, myrtle (*Myrtus bullata* and *M. obcordata*), *Carpodetus*, *Hedycarya*, kiekie, *Myrsine Urvillei*, kawakawa (*Piper excelsum*), with many perching ferns and epiphytes on the exposed roots of the swamp trees and branches.

K 246.—Collected (18/8/18) in small flax swamp, about 15 acres, in Ngarara West A Block, Section 45, near Waikanae; drained, and now growing *Phormium tenax*, *Mariscus*, *Carex secta* (niggerhead), and English pasture in interspaces.

K 363.—Collected (2/9/18) in drained niggerhead swamp. Sampled to depth of 9 in. Black soil. Situated two miles north of Paekakariki Railway-station, on main road. Native covering—niggerhead, *Mariscus*, and rush (*Juncus* sp.)—being converted into English pasture grasses. As there are many buried stumps the original vegetation was probably pukatea swampy forest.

K 377.—Collected (21/9/18) in Jensen's improved swamp land, Block VIII, Waitohu Survey District, Section 6, Ngakaroro. This was originally a swamp, but has now been drained, and is carrying a good rye-grass and clover pasture, with some tall fescue at edges. Black soil taken from a flat area about 30 ft. below the Otaki sandstone scarp.

K 381.—Collected (21/9/18) in white-pine association in recent sand hollow on west side of road one mile south of Te Horo. Forest consists of white-pine, tawa, with a little red-pine (rimu). Underscrub of mahoe, supplejack, kohekohe, rangiora, hangehange, lancewood, *Coprosma grandifolia*, *Myrsine Urvillei*, *Knightia*, *Hedycarya*, lawyer (*Rubus australis*), &c.

K 385.—Collected (12/9/18) from a well-known paddock adjacent to the Manawatu River at the Foxton Bridge, which consists of partially submerged flats growing a pure association of *Glyceria fluitans* (floating manna-grass). This water-grass contains a comparatively large amount of sugar, and is hence eagerly devoured by cattle. The area is used as a fattening-paddock for stock as soon as the flood-waters subside low enough. Sample taken to 9 in. depth.

K 391.—Collected (23/9/18) in forest opposite Ravensworth Dairy Factory. Originally white-pine forest, judging from the numerous stumps and saplings, but now growing forest of tawa, *Knightia*, mahoe, titoki, hinau, matai, with underscrubs of *Melicope simplex*, ribbon-wood (*Hoheria lanceolata*), supplejacks, *Muchlenbeckia australis*, milk-tree (*Paratrophis heterophylla*), *Coprosma areolata*, tree-ferns, *Myrtus bullata*, *Pseudopanax*, *Myrsine Urvillei*, *Parsonsia*, *Passiflora*, ngaio, poroporo, maire, *Carpodetus*, clematis, *Gahnia xanthocarpa*, and ferns.

MANAWATU DISTRICT HUMUS SOILS.—CHEMICAL ANALYSES.

Results except * are percentages on soil dried at 100° C.

Laboratory No.	Locality.	Volatile Matter.		Total Nitrogen.	1-per-Cent. Citric-acid Extract, Dyer's Method; Hall's Modification ("Available" Plant-food).				Hydrochloric-acid Extract ("Total" Plant-food).				Lime-requirement (Per-centage CaCO ₃).		
		* On Air-drying.	* At 100° C.		On Ignition.	Lime, CaO.	Magnesia, MgO.	Potash, K ₂ O.	Phosphoric Acid, P ₂ O ₅ .	Lime, CaO.	Magnesia, MgO.	Potash, K ₂ O.	Phosphoric Acid, P ₂ O ₅ .	On Air-dried Soil.	On Soil dried at 100° C.
<i>Flax, Raupe, and Herbaceous Swamps.</i>															
H 376	Waikanae.	61.0	2.49	18.01	0.420	0.869	..	0.019	0.014	0.97	0.54	0.09	0.17	0.00	..
K 377	Otakei: Jensen's swamp	67.3	31.26	85.27	2.378	0.175	0.239	0.025	0.069	1.60	0.09	0.21	0.17	0.37	0.77
K 385	Forston Bridge: Humus silt	58.1	7.40	28.21	1.077	0.408	0.018	0.018	0.007	1.16	0.81	0.71	0.71	0.26	0.54
K 397	Tokomaru: Flax swamp	61.8	21.02	43.35	1.386	0.259	0.073	0.030	0.017	0.75	0.49	0.40	0.24	0.23	1.00
K 446	Ngarara West: Flax swamp	78.5	37.94	63.26	2.488	0.957	0.320	0.078	0.037	2.58	0.63	0.24	0.24	0.29	..
K 517	Tane: Flax swamp	45.6	5.38	15.78	0.482	0.331	0.084	0.038	0.016	1.10	1.35	0.58	0.12	0.12	0.26
K 521	Mirinui: Flax swamp	70.3	9.58	31.41	1.367	0.391	0.134	0.049	0.016	1.00	0.38	0.59	0.20	0.20	0.73
K 523	Mirinui: Flax swamp	67.9	13.64	47.00	1.230	0.331	0.134	0.049	0.016	1.00	0.38	0.59	0.20	0.20	0.73
L 433	Paraparaumu: Flax swamp	51.2	8.16	35.01	1.022	0.213	0.094	0.039	0.022	0.48	0.40	0.40	0.17	0.00	0.08
L 140	Waikanae: Price's and Hadfield's swamps	58.0	25.14	70.64	2.849	0.746	0.219	0.040	0.026	0.93	0.74	0.20	0.32	0.32	1.34
L 141	Te Horo: Singer's Swamp	50.4	28.81	61.75	2.385	0.344	0.168	0.034	0.006	0.93	0.74	0.20	0.32	0.16	2.00
L 166	Waikanae: Brown's swamps	63.7	21.07	70.00	2.381	..	..	0.041	0.015	2.12	0.60	0.44	0.35	..	..
J 118	Rangitane: Flax-mills (Seifer's), top	43.7	6.24	11.42	0.574	..	..	0.071	0.020	1.14	1.15	0.33	0.10	..	..
J 121	Rangitane: Flax-mills (Seifer's), bottom	47.6	8.70	11.47	0.774	..	..	0.018	0.019	1.26	1.32	0.35	0.12	..	..
<i>Subsoils of Flax, Raupe, and Herbaceous Swamps.</i>															
K 378	Subsoil of K 377	41.4	67.12	90.80	1.867	0.369	0.167	0.031	0.005	2.45	0.72	0.51	0.51	0.81	2.90
K 386	Subsoil of K 385	78.4	10.85	34.77	1.521	0.482	0.173	0.059	0.031	0.86	0.67	0.38	0.31	0.31	0.46
K 396	Subsoil of K 397	78.4	10.85	34.77	1.521	0.482	0.173	0.059	0.031	0.86	0.67	0.38	0.31	0.31	0.46
K 516	Subsoil of K 517	85.7	14.58	78.18	2.715	0.779	0.334	0.133	0.023	2.17	0.63	0.35	0.35	0.74	0.78
K 520	Subsoil of K 519	..	11.80	46.50	1.566	0.383	0.142	0.034	0.010	1.04	1.02	0.75	0.16	..	..
K 522	Subsoil of K 520	60.0	7.58	21.10	0.555	0.304	0.065	0.036	0.013	1.02	1.02	0.53	0.12	0.38	0.41
K 524	Subsoil of K 521	68.8	12.26	49.88	1.385	0.521	0.167	0.064	0.019	1.29	0.68	0.38	0.21	0.70	0.80
L 434	Subsoil of K 523	80.0	12.44	59.81	1.425	0.127	0.040	0.033	0.029	0.35	0.44	0.32	0.14	0.92	1.10
L 440	Subsoil of L 433	38.6	5.06	16.01	0.348	0.538	0.064	0.057	0.007	2.21	0.40	0.27	0.19	1.06	0.42
L 141	Subsoil of L 141	..	14.74	81.49	..	..	..	..	..	..	..	..	..	1.30	1.63
L 142	Subsoil of L 141	..	20.44	73.95	..	..	..	..	..	..	..	..	..	..	..
L 167	Subsoil of L 166	70.4	30.29	77.16	2.088	..	..	0.081	0.012	1.03	0.39	0.09	0.20	..	..
J 119	Subsoil of J 118	52.6	11.66	18.78	0.383	..	..	0.012	0.013	1.19	0.98	0.27	0.10	..	..
J 121	Subsoil of J 121	54.0	8.24	44.64	0.444	..	..	0.014	0.013	1.03	0.93	0.32	0.09	..	..
<i>Swampy Forests on Soil.</i>															
L 417	Paekakariki: White-pine forest (opposite Lyrachs)	58.3	12.74	46.98	1.450	0.324	0.153	0.045	0.024	0.27	0.56	0.18	0.24	0.18	0.55
L 441	Waikanae: White-pine forest (opposite Taiton Fraser's)	31.2	5.72	13.78	0.484	0.169	0.050	0.038	0.029	0.57	0.19	0.71	0.16	0.46	0.49
K 363	Paekakariki: Niggerhead swamp with raupe	70.2	13.42	54.71	1.432	0.463	0.113	0.060	0.028	1.54	0.34	0.32	0.24	0.94	1.17
K 391	White-pine swamp..	27.8	3.54	9.12	0.300	0.096	0.039	0.034	0.009	0.38	0.28	0.22	0.05	0.22	0.23

MANAWATU DISTRICT HUMUS SOILS.—MECHANICAL ANALYSES.

Results are percentages on air-dried soil.

MANAWATU DISTRICT HUMUS SOILS.—MECHANICAL ANALYSES.											
Results are percentages on air-dried soil.											
Lab. No.	Description of Soil (Classification of U.S. Department of Agriculture, modified.)	Analysis of "Fine Earth" passing 2 mm. Sieve.								Stones and Gravel.	
		Fine Gravel.	Coarse Sand.	Silt.	Fine Silt.	Clay.	Moisture on Ignition.	Loss			
<i>Subsoils of Swampy Forests on Silt.</i>											
L 418	Subsoil of L 417 ..	29.4	11.88	52.00	1.456	0.386	0.137	0.040	0.011	1.04	0.52
L 442	Subsoil of L 441 ..	31.1	7.20	12.54	0.380	0.126	0.038	0.029	0.015	0.93	0.73
K 364	Subsoil of K 363 ..	80.5	12.84	70.60	0.384	0.109	0.040	0.010	0.010	..	..
K 392	Subsoil of K 391 ..	31.3	4.30	5.28	0.158	0.042	0.041	0.020	0.002	0.54	0.30
<i>Swampy Forest on Sand.</i>											
K 381	Te Horo: White-pine on sand ..	27.8	13.84	12.37	0.221	0.214	0.074	0.038	0.009	1.01	0.42
H 384	Waikanae: Swampy forest on sand ..	35.0	16.98	10.86	0.186	..	..	0.037	0.010	0.99	0.35
H 623	Levin: White-pine on sand ..	30.3	13.23	19.03	0.478	..	..	0.015	0.013	0.77	0.08
L 393	Foxton: Swampy forest on sand ..	48.7	24.21	16.95	0.567	..	..	0.036	0.023	1.57	0.26
L 136	Te Horo: Swampy forest, drained ..	..	17.08	47.80	1.926	0.363	0.154	0.044	0.010	..	..
L 435	Waikanae: Manuka bog ..	..	15.26	76.78	1.646	0.180	0.204	0.037	0.020	0.20	0.20
<i>Subsoils of Swampy Forest on Sand.</i>											
K 382	Subsoil of K 381 ..	32.3	3.46	8.88	0.284	0.157	0.039	0.027	0.005	0.65	0.41
H 385	Subsoil of H 384 ..	23.0	7.52	4.53	0.039	..	..	0.014	0.008	0.88	0.19
H 624	Subsoil of H 623 ..	27.4	11.08	10.61	0.214	..	..	0.009	0.008	0.74	0.13
L 137	Subsoil of L 136 ..	..	21.30	65.21	2.554	0.390	0.146	0.061	0.005	1.44	0.53
Analysis of "Fine Earth" passing 2 mm. Sieve.											
Stones and Gravel.											
Moisture on Ignition.											
Loss											
H 376	Sandy soil	..	..	..	66.0	7.0	0.6	1.7	25.3	..	..
K 385	Silt loam	..	..	..	14.7	13.4	18.9	21.4	33.5	..	..
L 118	Silt loam	..	..	..	16.9	33.8	32.2	3.8	19.2	..	..
J 121	Sandy silt	..	..	..	28.4	19.0	11.6	3.0	30.0	..	..
J 119	"	..	..	..	10.1	22.0	13.8	3.0	21.8	..	..
J 122	Silt loam	..	..	..	Nil	18.9	29.6	23.6	2.1	..	..
L 441	Sandy loam	..	..	..	..	33.3	24.6	12.4	11.8	..	..
K 391	"	..	..	..	..	26.1	37.7	14.7	10.3	..	..
K 392	"	..	..	..	..	26.7	33.7	12.3	15.9	..	..
K 381	"	..	..	..	..	50.4	12.2	7.3	5.5	..	..
H 384	"	..	..	..	..	60.5	8.2	1.1	Nil	..	..
H 623	"	..	..	..	..	60.2	2.2	0.1	..	..	..
K 382	"	..	..	..	..	68.0	11.8	7.2	3.7	..	..
H 385	"	..	..	..	..	72.4	9.0	3.2	Nil	..	..
H 624	"	..	..	..	..	69.9	2.2	0.1	..	..	..

K 397.—Collected (23/9/18) in Makerua flax swamp, near Tokomaru Railway-station, in black soil growing a pure dense association of phormium.

K 517.—Collected (22/12/18) from the swamp of Timukanui Limited, from a flax area affected with yellow-leaf.

K 519.—Collected (22/12/18) in Tane flax swamp (Seifert's), Block 2G, near bridge, in an area very badly affected with yellow-leaf. Area much infested with tall fescue.

K 521.—Collected (3/1/19) in Mirinui flax swamp (Seifert's), near Shannon, beyond drain and near Sweater's corner.

K 523.—Collected (3/1/19) in Mirinui flax swamp, second turn past Shannon drain.

L 136.—Collected (15/6/19) in drained swamp, Te Horo (Singer's). Sampled 1 ft. deep. Land in hummocks, stumps, and grass.

L 141.—Collected (15/6/19) at Te Horo, in Singer's drained swamp, containing large number of tree-stumps (matai, totara, rata, pukatea). Now coming into grass. Native Block 2F 3A.

L 417.—Collected (19/9/19) in swampy forest growing white-pine, pukatea, swamp-maire, kiekie, *Muehlenbeckia australis*, ngaio, *Coprosma*, wineberry, *Schefflera*, tutu, *Clematis indivisa*, *Geniostoma*, mahoe, supplejack, *Pittosporum*, with raupo swamp round the edge of the forest. Lynch's Bush, Paekakariki, on west side of railway-line, opposite Lynch's homestead. Black soil.

L 433.—Collected (20/9/19) in Mrs. Hadfield's flax swamp, Paraparamu, below forest. Almost a pure association of dense phormium with occasional niggerhead and trace of *Mariscus*.

L 435.—Collected (20/9/19) in manuka bog near Waikanae. Vegetation consists of stunted manuka, bracken, sphagnum moss, rushes, and *Lomaria capense* (bog variety). Water-level very near surface.

L 439.—Collected (21/9/19) in F. Price's swamp land, Waikanae (next to Brown's flax swamp), part of Hadfield's estate. Partly grassed flax land, previous to that was a niggerhead swamp with much buried timber.

L 441.—Collected (21/9/19) in swampy forest similar to No. 417. Tatton Fraser's, west side of railway-line, opposite Tatton Fraser's homestead, Waikanae. Pukatca, tawa, and *Muehlenbeckia australis*, abundant; also wineberry, mahoe, *Coprosma grandifolia*, *Cyathea medullaris*, kiekie, nikau, poroporo, with occasional trees of white-pine. Forest much invaded by elder. Taken to a depth of 9 in.

(To be continued.)

Rabbit-poisoning.—Mr. McGregor, of Mount Linton, supplements his remarks on rabbit-poisoning at the head of page 8 in last month's *Journal* by a note to the effect that, where possible, the phosphorized pollard should be laid in a very light plough-furrow, or even on a sod turned over with a spade or mattock. This often gives a most satisfactory result, and stock are less liable to pick up the baits.

PLANT INDICATORS.

A NEW LINK BETWEEN SCIENCE AND PRACTICE IN AGRICULTURE AND FORESTRY.

DR. L. COCKAYNE, F.R.S., F.N.Z.Inst., Wellington.

AT the present time, as an outcome of the war, the national importance of scientific research is in the public mind as never before. But when this appreciation of science is analysed it stands out clearly that only the application of the various sciences is usually meant—the research to be entirely of an economic character. Indeed, the non-scientific belief is that “pure science,” as it is styled, is of comparatively little moment. It should be needless to point out how fallacious is this standpoint, for a moment's thought shows that there could be no application of pure science if the latter did not exist. In point of fact there can be drawn no distinction whatsoever between the alleged two classes of science, for what is “pure” to-day may be “applied” to-morrow, while there is, moreover, only the one scientific method, that of attempted exactitude.

Clements's latest work, “Plant Indicators”^{*}—undoubtedly in a few years to be called “epoch-making”—thus appears at an opportune moment. It has, indeed, the peculiar distinction of being written in the academical lines of pure science, yet its sub-title, “The Relation of Plant Communities to Process and Practice,” shows that the ultimate goal of its teaching is the practical application of the principles inculcated in its pages. In short, the production of crops and the proper utilization of certain portions of the natural plant-covering of a country, especially the grasslands and forest, is a striking feature of the book. For this reason an extended notice of the work seems called for in this *Journal* notwithstanding its necessarily popular character.

The author of “Plant Indicators,” Dr. F. E. Clements, of the Carnegie Institute of Scientific Research, one of the foremost investigators in plant ecology, has done much to raise that fundamental, but recent, division of botany to the high place it now occupies, and to introduce those exact methods into its technique which are bringing it into line with other exact sciences.

This term “ecology” may need some explanation, since it is a comparatively recent development of botanical science. It may be defined as that branch of botany, or zoology, which deals with the relation of the living organism to its surroundings, these being termed the “habitat.” With regard to plants, which alone concern this article, ecology treats, in large measure, of their individual forms as regulated by their environment and of the communities into which nature has placed them, such communities being termed in New Zealand writings, plant-forma-

^{*}F. E. Clements, “Plant Indicators: The Relation of Plant-communities to Process and Practice,” Carnegie Institution, Washington, 1920, pp. 388 + xvi, plates 92, text-figs. 25.

tions and plant-associations, as the case may be. Forest, grassland, swamp, salt meadow, and scrub are familiar examples of plant-formations in this country, and of each of these there are distinct classes called plant-associations. In each association one or more species may be dominant — e.g., fescue-tussock (*Festuca novae-zelandiae*) in mountain grassland, rimu (*Dacrydium cupressinum*) in one association of taxad* rain-forest, and raupo (*Typha angustifolia*) in lowland swamp. All plant-associations have a life-history of their own, the different stages of their progression being collectively known as "succession," and the final association being "the climax." The "habitat" consists of the climate and soil, together with the conditions brought about by the plants themselves and the animals with which they are associated. Water, heat, light, wind, nutritive salts, and various kinds of soil are some of the factors regulating the composition of the association and the forms of its members.

The author commences his work with the statement that "Every plant is a measure of the conditions under which it grows. To this extent it is an index of soil and climate, and consequently an *indicator* (the italics are the reviewer's) of other plants and animals on the same spot." Further on (p. 20) it is laid down that "Every plant is an indicator. This is an inevitable conclusion that each plant is the product of the condition under which it grows, and is thereby a measure of these conditions." "The chief objective for the student of indicators," according to the author, "is the cause-and-effect relation, and his chief task to show how effects may be used as signs of their causes." This leads up to the economic significance of indicator work, and the author rightly states that "it is invaluable in land classification, and to the great plant industries, agriculture, grazing, and forestry." And, further, "wherever plants grow in field, forest, grassland, or desert, indicator results are always of some and usually of paramount importance."

This indicator phase of ecology is in its early infancy, and dates only from Shantze's† paper on the indicator value of natural vegetation, published in 1911. Now, though this may be true enough so far as methods of precision go, the significance of indicators had to some extent been recognized in the past, as Clements points out, especially in newly settled regions. In New Zealand, for example, though botany has had little to say in the matter, practice early in the development of the land made more or less use of plant indicators. Thus, manuka (*Leptospermum scoparium*) scrub is considered a sign of poor soil; kahikatea (*Podocarpus dacrydioides*) forest is known to occupy land eminently suitable for dairying; the soil on which taxad rain-forest grows is far richer than that occupied by southern-beech (*Nothofagus*) forest; the monoao (*Dracophyllum subulatum*) indicates the most barren soil of the Volcanic Plateau; the ground occupied by kohekohe (*Dysoxylum spectabile*) coastal forest in the Marlborough Sounds area is well suited for occupation by permanent pasture; wild-irishman

* Taxad rain-forest is the ordinary New Zealand "bush" when one or other of the "pine-trees" are dominant. But these trees are rather yews (*Taxus*) than pines (*Pinus*), hence the more correct term "taxad."

† "Natural Vegetation as an Indicator of the Capabilities of Land for Crop-production in the Great Plains Area," U.S.A. Bur. Plant Industry, Bull. 201, 1911.

(*Discaria toumatou*) in the arid parts of Central Otago is an indicator of rich mica-schist soil, but when growing with greywacke as the underlying rock it denotes barren, stony ground. From the above examples, so readily observed, it seems clear that definite New Zealand research regarding indicators should lead to rich results.

Notwithstanding what has just been said, generally speaking, the time is past for indigenous indicators to be of much use in New Zealand agriculture, though here the indicator method, using the experiences of more than seventy years' farming, and the studying, with an analytic eye, succession in artificial pastures, may well furnish valuable material for advance. On the other hand, the tussock-grasslands of the South Island—semi-virgin as they must remain for many years—can be improved only by the application of methods derived from plant-ecological research, and the recognition of indicators. For instance, the investigation of the Agriculture Department has shown how the intensity of the rabbit pest is indicated by certain stages of depletion and the presence of certain plants, culminating in the appearance of countless circular mats of the scabweed (*Raoulia lutescens*) and its allies. So, too, does the dominance of the blue-tussock (*Poa intermedia*) suggest a totally different treatment as to burning, on account of its higher palatability when not burned, from that of areas where the fescue-tussock (*Festuca novae-zelandiae*) dominates.

Throughout the work under consideration the author insists, as all conversant with his former writings would expect, on an intensive study of succession and on the use of the quadrat method. This latter is the mapping-out of the plant-contents of small areas, and, in experimental quadrats, observing from time to time the changes occurring therein. The experimental areas of the Department on the Dunstan Mountains contain quadrats of the latter category.

Another matter, but one extremely problematical, on which Clements insists (pp. 247-55) is what he calls "climatic cycles." "The best-known and most significant of climatic cycles for the present day is the eleven-year cycle and its multiples," he writes. Further, "the eleven-year cycle is known also as the sun-spot cycle, owing to the striking correspondence with the sun-spot period. The outstanding fact is that our knowledge has reached a point where it seems increasingly possible to employ the sun-spot cycle as a method of anticipating the coincident or related changes in climate and vegetation."

Part III of the work deals with the different kinds of indicators. Here only lime indicators will be referred to. Not so long ago certain plants were considered lime-loving and others lime-hating. This doctrine is well-nigh defunct. New Zealand supplies an interesting example. Sorrel (*Rumex Acetosella*) may be taken as a typical alleged lime-hater, an indicator of sour ground, while white clover (*Trifolium repens*) is a lime-lover. Yet in all New Zealand white-clover seed sorrel is a most common impurity. Sorrel also grows abundantly on extremely fine limestone debris; it is indeed common both on "sour" and "sweet" soils.

Part IV is concerned with an account of the climax formations of western North America. The portions referring to grassland and scrub are especially interesting for comparison with New Zealand associations. Some of the North American grassland plants very much

need introducing into this country, especially for Central Otago. It is astonishing, judging from the photographs, how much alike in general appearance are certain western North American and New Zealand grass and shrub associations.

Parts V, VI, and VII, dealing with "Agricultural Indicators," "Grazing Indicators," and "Forest Indicators," which occupy 125 pages, especially concern this article. Leaving the first-named on one side and turning to grazing indicators, it is here that American experience can specially benefit New Zealand, since both regions, with regard to their natural high-land pastures, are confronted with the problem of depletion. So far has America advanced in the direction of its solution that Clements declares that most of the ranges (sheep or cattle runs), where grazing has been administered on the basis of a definite carrying-capacity, have so far regenerated that they have to a large degree recovered their normal carrying-capacity.

As the treatment of grazing indicators occupies sixty-three pages it is impossible to do more than refer to a few points. First of all comes the question of carrying-capacity. This is a more complicated matter than first appears. The author points out (p. 284) that "each kind of stock has its own preferences, as that of cattle for grass and sheep for herbs, while horses and sheep utilize a forage cover much more completely than cattle." This statement that sheep have a preference for herbs is well worthy of testing in New Zealand, for it should not be difficult to add many exotic herbs to our pastures. To a certain extent the foregoing generalization is confirmed by the tussock-grassland investigation of the Department, for it has proved that sheep are especially fond of catsear (*Hypochoeris radicata*), yarrow (*Achillea millefolium*), and hawksbeard (*Crepis capillaris*). On the other hand, but few indigenous herbs or semi-woody plants are eaten, but a notable exception is the anise (*Angelica montana*).

To exactly ascertain the carrying-capacity of the runs is rightly considered of great moment. An actual grazing-test may certainly tell a good deal, but, as the author points out, "so many factors enter into practical grazing that experience alone is not a reliable guide." It must be refined and supplemented by experimental tests under controlled conditions which permit varying one factor, such as grazing type* or kind of animal, while other factors remain essentially the same." Then there is the present carrying-capacity and, what is of more importance, the potential carrying-capacity, the latter being the final aim of improvement in New Zealand, where the carrying-capacity of the primitive grassland was remarkably low. Here also comes in the certain increase in carrying-capacity of much of the summer country if more winter country were available, to say nothing of reducing the snow risk to a minimum.

Intimately bound up with the carrying-capacity of a run is the relative palatability of the components of the pasture. This was fully recognized at the very commencement of the Department's investigation. Constant observations have been made in many parts of the South Island of sheep feeding under natural conditions, and experiments carefully conducted. Already much light has been shed on the

* Grass, herbs, shrubs, and trees are different types.



AGROPYRON PASTURE IN OREGON

Showing great similarity to New Zealand tussock-grassland.



PASTURE IN RANGE COUNTRY, ARIZONA.

Showing protected area on left of fence, and depleted ground on right. Compare with Fig. 7 and other illustrations in article V, New Zealand Tussock-grassland series, in February, 1920, issue of *Journal*.

[Illustrations reproduced from Clements's work, Plant Indicators.]

relative value of the natural pastures. But the question arises, are these specially palatable plants particularly nutritious? Here the remarks of Clements are full of weight. Concerning certain tables in which the nutrition-content of many pasture plants are given he declares that "differences in palatability are more important than those of nutrition-content. . . . It is surprising to find some grasses which ordinarily are grazed little or not at all possessing as high a nutrition-content as the best species of the range [run]. It is equally surprising to find that many annuals possess apparently a higher nutritive value than related perennial species of much greater grazing-value." When the knowledge of relative palatability becomes more complete it should be possible, with the aid of the quadrat method, to classify the mountain pastures of New Zealand on a palatability basis. The importance of such a result does not need stressing.

The section concerning "overgrazing" is of peculiar interest through the use which can be made of plant indicators to show the exact phase of overgrazing reached. Nothing on this head has yet been published with regard to New Zealand pastures, where the question is greatly complicated by the effect of burning, the depredations of rabbits, and the incoming of pasture-plants more palatable than those of the original grassland. It is easy enough to see that a New Zealand pasture is deteriorating; doubtless there are many indicators of the various stages—e.g., species of *Raoulia*, decrease in size of the tussocks, increase of bare ground, increase of the Maori onion (*Chrysobactron Hookeri*), and increase of certain shrub associations. But aspect plays a notable part with regard to deterioration, so that quite a slight difference may result in a different combination of plants. In any case, indicators will first appear on sunny slopes.

The final section relating to pastures deals with their improvement. This does not concern their replacement by an association more palatable than the original, but a return of the more or less depleted or degraded pasture to its primitive condition, this being assumed to be the best suited to the habitat, as it is a climax formation. This aim is different from that of the research instituted by the Department. Here it was soon discovered that, though the New Zealand climax association might be the best possible when only the indigenous flora was available, a good many exotic plants had entered the community and become as much its members as the original species; while, as for palatability, they are on the whole vastly superior. The aim, then, at present in our tussock-grassland, depleted or not depleted, is to so modify the pasture as to greatly increase its carrying-capacity.

The American plan, as detailed by Clements, a result of many-sided investigations, takes into consideration the following: (1) Proper stocking; (2) rotation or deferred grazing (in New Zealand called "spelling"); (3) eradication of rodents, poisonous plants, &c.; (4) manipulation of the range (run) by clearing, burning, &c.; (5) improving the cover by sowing and planting; (6) forage-development; (7) water-development; (8) herd-management. Contributing factors are found in classification and range surveys, the economic aspects of the ranch system, and an adequate land system. It seems strange to us in New Zealand that the damage done by rodents was not appreciated till 1899. At present, poisoning is considered the only method for their eradica-

tion. With regard to plant-introduction, a certain number of attempts have been made, but so far with little success. There appears nothing equivalent to our surface-sowing.

Finally, there remains for mention the matter of forest indicators. These, according to Clements, are of the following three chief types: (1) Those that have to do with existing forests; (2) those that indicate former forests; (3) those that indicate the possibility of establishing new forests. Both the individual and the community may be taken as indicators. Taking the case of New Zealand, what do our forest communities teach as indicators? Leaving swamp forest out of consideration, there are two main types of forest, the taxed rain-forest and the southern-beech (*Nothofagus*) forest. The taxed rain-forest, in many respects, is akin to tropical rain-forest. Its structure and life-history are altogether different from those of the pine, or deciduous forests of the Old World and America, whence come the practices and art of modern forestry. Obviously our rain-forest must be considered on its merits. Nothing less than an intimate acquaintance with its life-history, not possessed at the present time, together with an ecological classification of its associations and their divisions, will point the road towards its best economic management. So, too, should the southern-beech forests be exhaustively studied in their turn, as well as the connecting-links between these and rain-forest. So from New Zealand studies of New Zealand forests would arise, so far as the indigenous forests are concerned, a true New Zealand forestry.

There are many important subjects in Clements's work not touched on here. The book itself must be read by those interested, and should certainly be in the hands of all who are studying in the field some of the many problems—agricultural, pastoral, or silvicultural—which New Zealand offers for investigation, and on the successful solution of which the national prosperity to no small degree depends.

Farm-school for Farmers at Ruakura.—A special school for farmers (the second) was held at the Ruakura Farm of Instruction, Hamilton, from 12th to 17th July, under the joint management of the Department of Agriculture and the Auckland Education Board. The school was attended by 82 farmers from various districts, while 30 returned soldiers and 15 cadets in residence at Ruakura brought the total present attendance up to 127. The course of instruction comprised divisions dealing with general agriculture, dairying, live-stock, and wool. Each division proceeded simultaneously, and the attendance was fairly evenly distributed. A popular and very practical extra feature of the school was an hour's daily "round the farm" walk and demonstration, conducted by the Farm Manager, Mr. A. W. Green. In addition to the regular instruction many farmers also availed themselves of the opportunity of consulting with the officers in charge of the poultry, horticulture, orchard, and apiary sections of the farm. Fine weather prevailed during the week, and the whole programme was successfully carried out, the social side being also very happily featured.

SHEEP-MANAGEMENT NOTES.

I. CARE OF EWES PREVIOUS TO AND DURING LAMBING.

F. MACKENZIE, Inspector of Stock, Christchurch.

THE period for which a ewe carries her lamb is about 150 days. Ewes during this period should be kept in ordinary keeping-condition, rich fat-producing foods being avoided as far as possible, especially during the last six weeks of pregnancy. Probably the greatest mistake made by breeders is in allowing their ewes to get too fat at this period, thereby causing such conditions as ante-partum paralysis and eversion of the vagina. These are the two most common diseases affecting in-lamb ewes.

Feeding.—For the proper management of pregnant ewes on arable or partly arable farms a paddock of green feed should be grown, such as oats, vetches, or Cape barley, &c. The ewes should be driven to this feed daily, and allowed to depasture thereon for a short time (not more than half an hour for the first few days), afterwards being taken quietly back to their original pastures. On no account should the ewes be placed on the green feed during wet weather or on frosty mornings, as they are then very liable to get blown (tympanites). Consequently they should be put on the green feed as near midday as possible. During the later period of pregnancy ewes should not be fed on turnips or rape. The worst case of ante-partum paralysis I have ever seen was among a small flock of ewes running on a paddock of old rape, thirty of these ewes dying in two days out of a flock of less than two hundred.

Exercise.—This is another very important factor in the health of pregnant ewes. Where it is found inconvenient to grow green feed owners should see that the ewes are taking sufficient exercise, as when feed is abundant the ewes fill themselves without taking more exercise than they can possibly help, naturally putting on a lot of fat and getting very lazy. This condition is readily observed by seeing the ewes lying about for long periods, and the lazy and listless manner in which they move away when approached by the shepherd or his dog. When such conditions are apparent the ewes should be quietly driven round the paddock several times daily, or driven some distance from one paddock to another. I have seen excellent results from this practice. Naturally when sheep are placed in a fresh paddock they will roam around it, and in this way get the necessary exercise. It will also be found that ewes that have had plenty of exercise rarely have any trouble in lambing, and mortality will be reduced to a minimum.

Lambing.—Immediately previous to lambing the ewes, if possible, should be placed on a clean paddock—that is, a paddock where lambing has not taken place for a few years. The reason for this is that where ewes have lambed the soils may become infected with

material which causes disease. The decomposition of the cleansings, and also diseases which may have attacked lambs and ewes previously, such as navel-ill in lambs, and metritis or septic inflammation of the womb in ewes, leave the soil teeming with disease organisms. On no account should in-lamb ewes be allowed on the ground where tailing and marking has taken place the previous season, as these yards are generally hotbeds of disease-producing germs.

When it is found necessary to assist a ewe in lambing, care should be taken to place her on a clean part of the pasture. The hands should be thoroughly cleansed in water to which a small quantity of disinfectant has been added, and then smeared with carbolic ointment before starting operations.

Saving Lambs.—A considerable number of newly dropped lambs perish owing to violent rain, sleet, and sometimes snowstorms. On small holdings where the lambing-paddocks are convenient to the home-stead or other buildings many can be saved. I have found the best method is to place the half-perished lambs in a box or other receptacle in which a liberal supply of chaff (for preference cavings from the threshing-mill) has been placed. The lamb's body should be well covered with chaff, and the head placed on a piece of thin sacking to keep it from getting embedded in the chaff. The chaff seems to absorb all the wet from the skin, and supplies a natural heat to the whole of the body. By this method I have saved hundreds of lambs that were apparently past all hope of recovery, and it will be found much more effectual than and preferable to the general practice of bringing them into the house and placing them near a fire. When the lamb is sufficiently revived to be able to swallow it should be given a small quantity of new milk to which has been added boiled water in the proportion of two parts milk to one part water.

After-care.—Ewes that have lambed should be drafted from the remainder of the flock and removed to better pastures. Ewes with twins should be separated from those with single lambs. The former can be placed with safety on the best pasture available, while the latter should be put on pastures that are less abundant. If this method is adopted much of the mortality among lambs from plethora will be avoided. I quite recognize that it is very difficult to advise farmers on this trouble, as it is the aim of most farmers to fatten their lambs as quickly as possible. However, the disease is entirely due to dietetic influences, and can be controlled only by the restriction of the ewes' diet, thus reducing the secretion of milk for the lambs. The control of the trouble is therefore in the farmer's own hands.

Lucerne-meal of good quality is a highly nutritious stock-food. For calves it can be boiled or steamed with a little ground linseed-meal and added to skim-milk, while for pigs and poultry it can be used as a mash. A sample of lucerne-meal analysed by the Department's Chemist in 1916 gave the following result: Moisture, 13.8 per cent.; ash (including sand, 4.1), 13.4; ether-extract (fats), 1.3; woody fibre, 10.3; protein, 20.6 (equivalent to nitrogen 3.3); carbohydrates, 40.6 per cent. Purchasers should beware of low-quality meal containing a large proportion of woody fibre (stalks).

CULTIVATION OF ROOT CROPS.

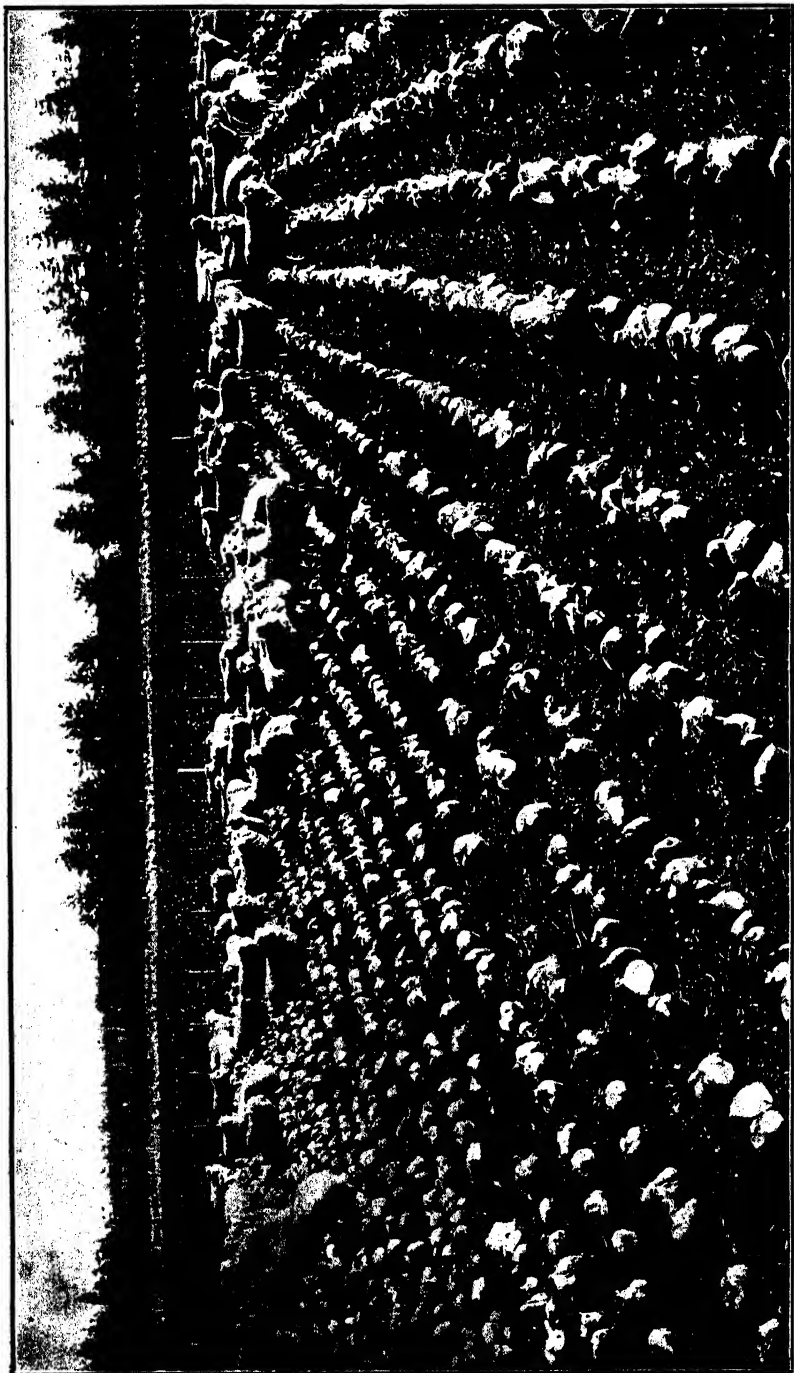
AN OBJECT-LESSON AT WERAROA.

W. J. McCULLOCH, Manager, Central Development Farm, Weraroa.

DURING the past season an area at the Central Development Farm was, as usual, devoted to various tests with field roots. Quite apart from the usual comparisons made between varieties, &c., grown in the same field under similar conditions, it was admitted by all who visited the area that the ridged crop of swedes was superior by many tons per acre to the usual flat-sown or broadcast crop commonly seen throughout a large surrounding area of the Horowhenua and Manawatu districts. An extremely interesting comparison was afforded by a crop of swedes on an adjoining property, which was separated from the Central Development Farm field by a wire fence only, being on land exactly similar in quality. This neighbouring crop, however, had been sown on the flat and no opportunity given for intercultivation, consequently the weeds controlled the crop, which would probably yield only one-fifth by weight per acre of that growing within a few feet on the State farm. The great difference in yield was mainly due to the difference in method of cultivation, and certainly not to the quality of the land.

From observation, it is quite evident that in many cases the limiting factor in yield of root crops is lack of proper cultivation. This is especially noticeable in connection with crops on land other than maiden soil, for it is a regrettable fact that local custom in the past has often ignored the root crop as one of the cleaning-crops in a rotation. Thus the old saying, "One year's seeding, ten years' weeding," still holds good, and the weed-seed content of the soil steadily increases. The system of growing crops in rows wide enough apart to intercultivate and control weeds and moisture, as well as to assist the formation of plant-food, was first advocated in Britain by Jethro Tull in the eighteenth century, and this method has long since been proved correct both in principle and practice. A further advantage of ridged root crops is that as intercultivation takes place the raised drills become lowered, leaving the greater part of the root above-ground, and consequently little waste occurs in feeding off.

It has been suggested that the extra expense of ridging and scarifying is excessive, or that labour for thinning is unprocurable. This need not be the case, however, even where the area is greater than can be conveniently dealt with in the ordinary way by hand, if proper implements are used, such as the double-row ridger, double-row scarifier, and double-row thinner, each of which is capable of dealing with over 7 acres per day. In order to show which system will return the greater profit one cannot do better than give a comparison of the direct costs per acre, together with the yields, between



PART OF THE RIDGED AND INTERCULTIVATED SWEDE CROP AT THE CENTRAL DEVELOPMENT FARM.

the ridged swede crop (1) and that grown on the flat without inter-cultivation (2), as follows:—

(1.) Central Development Farm swede crop: Ploughing twice, £1 4s.; grubbing twice, 9s.; tine-harrowing twice, 3s. 6d.; rolling, 2s.; ridging (double ridger), 7s. 6d.; thinning (machine), 7s. 6d.; scuffling twice (double scuffer), 15s.; seed, 1½ lb., 5s. 3d.; manure, 3 cwt. superphosphate, £1 7s.: total, £5 0s. 9d. per acre. Yield, 50 tons per acre.

(2.) Adjoining swede crop: Ploughing once, 12s.; disking twice, 6s.; tine-harrowing twice, 3s. 6d.; clod-crushing, 2s.; drilling (on flat, 7 in. drills), 4s.; rolling, 2s.; seed, 1½ lb., 5s. 3d.; manure, 1 cwt. superphosphate, 9s.: total, £2 3s. 9d. per acre. Estimated yield, 10 tons per acre.

These figures speak for themselves, and should appeal to any practical farmer. Visiting farmers, indeed, all admitted the force of the demonstration. In brief, the ridging and intercultivation given the Central Development Farm crop paid handsomely. The larger amount of fertilizer doubtless helped the latter crop, but to all who inspected the two crops it was patent that the method of cultivation was the deciding factor between success and comparative failure.

In conclusion, it may be remarked that the foregoing observations refer more particularly to North Island practice.

OIL-SPRAYING TESTS ON APPLE-TREES.

IN order to remove the doubt that exists in the minds of a number of fruitgrowers as to what strength oil sprays can be used at with safety on apple-trees in the dormant season, a series of tests was carried out on 22nd August, 1919, by the Orchard Instructor at Motueka (Mr. W. T. Goodwin), using various oils from full strength (neat) up to 1 in 20. The trees operated on were Dunn's Favourite, four years of age. The following is a copy of the Instructor's report:—

These tests were mainly for the purpose of demonstrating to those orchardists in the district who were somewhat hesitant about spraying their trees with oil, 1-8 to 1-12, on the ground that such strengths would kill the trees, that oil could be used with perfect safety at the strengths recommended. In this direction the experiment was conclusive. Those trees sprayed with oil down to 1-4 showed no harmful effects whatever. Of those sprayed with neat oil, in one case only was any damage apparent. This tree lost one or two top buds; the next lower buds, however, came away and made excellent growth. The trees were watched throughout the season, and practically no difference was noticed in the growth made and the general healthy condition of the trees sprayed. The check rows, unsprayed, show a bad infection of San Jose scale. Those trees which were slightly backward at the commencement of the season, through having the stronger applications, caught up on the others during the season, and an average healthy growth of wood, ranging from 2 ft. 6 in. to 3 ft. 6 in. in length, was made throughout the whole test-plot.

DEVELOPMENT OF THE POULTRY INDUSTRY.

SMALL SETTLEMENT AND FEED-SUPPLIES.

F. C. BROWN, Chief Poultry Instructor.

THE writer has frequently advanced the view in the *Journal* that if the poultry industry of this country is to develop and multiply in importance the small settler on the land, conducting the business of poultry-keeping as a side-line, must be chiefly depended upon to produce the necessary eggs and table poultry. Some idea of the weight of this contention may be gathered from a paper on the poultry industry in Ireland read by Miss L. Murphy, Poultry Instructor, Munster Institute, Cork, at the International Poultry Conference held in London last March. Miss Murphy said that, as might be expected in a country of small holdings (out of a total of 572,574 holdings 409,353 are under 30 acres in extent), poultry-keeping forms an important branch of rural industry, and the great bulk of the export trade comes from the small farms and cottages. The poultry industry in Ireland has made such progress that it now furnishes the second-largest item in the country's exports of agricultural products. The export figures quoted for the years 1904 and 1917 afforded a striking comparison, as follows:—

Year.	Eggs.	Value.	Poultry.	Value.	Total Value: Eggs and Poultry.
	Hundreds.	£	Cwt.	£	£
1904 ..	5,470,260	2,188,104	233,525	625,870	2,813,974
1917 .. (estimated)	7,265,000	7,689,000	263,600	1,599,000	9,288,000

Excluding cattle (which rank first), the estimated value of the chief agricultural exports from Ireland for 1917 were: Pigs, £2,172,000; sheep, £2,399,000; horses, £527,000; dairy-produce, £7,987,000.

In view of these statements it may be safely assumed that the poultry industry in Ireland chiefly owes its success to the fact of that country having the great majority of its farmers on comparatively small holdings. It may also be assumed that the majority of Irish poultry-keepers grow most of their own poultry-food requirements, which in itself must be a big factor towards building up the industry. The latter factor is probably the greatest weakness in connection with poultry-keeping in New Zealand. Far too many poultry-keepers, and particularly those who conduct the business as a sole means of livelihood, are usually solely dependent on the general farmer to grow the necessary food-supply. Obviously the expansion of the poultry industry depends on the extent to which the farmer is prepared to perform this service. The position in regard to the poultry-food shortage of late years gives a striking proof of this. Owing entirely to this shortage and the inability of poultrymen to secure a regular food-supply the

industry has received a serious set-back. Laying-fowls have been seriously reduced, while hatching operations have been greatly curtailed.

It will thus be seen that the food question has an all-important bearing on the advancement or otherwise of the industry. Particularly does this apply where poultry is being kept in large numbers on small suburban areas. True, in many such cases highly profitable results are obtained. This is often proclaimed as the amount of money that can be made from poultry from, say, an acre or two of ground, and is also given as a basis on which the industry should be built up. Rarely, or never, however, is any reference made to the area of land required by the farmer to grow the necessary food. In this connection the poultry industry is an isolated one compared with most other industries of the soil. In view of the high prices paid for eggs and table poultry the question is often asked, Why should the poultry industry lag behind the dairy, the fruit, and the bee industries? The answer to this appears to be a simple one—namely, that the dairy cow generally feeds on the food grown by its owner, the fruit-tree feeds from the soil in which it is planted, while the bee, being a free roamer, mostly gathers its food at no expense to its owner. Those concerned in these industries can afford to lean on themselves, whereas the poultryman is dependent on the grain-grower for the maintenance of his flock. It is thus apparent how easy it is for poultry-production under our present system to have its ups and downs. Experience has repeated and will repeat itself in this direction. When fowl-feed is cheap and plentiful the industry advances at a solid rate, while, on the other hand, scarce and dear feed means a check to the industry in spite of the increased prices realized for the more limited production of eggs and table poultry.

In view of this and in face of the present food-shortage it is not easy to see how production can be steadily increased, except by increasing the number of small farms. Such a development would necessarily mean more fowls, the owners of which would be in a position to depend on themselves for the bulk of the poultry-food supply. Poultry-keeping is a most suitable side-line for the small settler, who as a rule resorts to mixed farming. He has many advantages compared with the suburban or semi-suburban commercial poultry-keeper. He has comparatively low-priced land, enabling him to give his birds plenty of range, whereby they secure a great part of their living. The surplus vegetables or root crops, or possibly skim-milk, can be all utilized in reducing the cost of feed for the poultry. There are also other advantages connected with the small-farm system. A small capital only is required at the outset. The poultry brings in profitable and regular returns, while the greater part of the work can easily be undertaken by the women-folk without resorting to hired labour. Farmers' daughters are also given an inducement to remain on the land, thus helping to check rural depopulation.

Generally speaking, the climatic and soil conditions in New Zealand are most favourable for poultry-culture. Heavy-producing stock and the knowledge of how to manage them on proper lines is available to all. Further, the demand exceeds supply, and market prices for the egg- and table-poultry product rule at a remunerative level. Yet in spite of these facts we have sufficient evidence to show that the poultry

stock of the Dominion has greatly decreased during recent years, and that the industry has gone backward instead of forward. It would appear that the solution of the problem depends on the growth of the small-settlement movement and a better assurance of a regular supply of food for poultry.

ORCHARD EXPERIMENTS IN STOKE DISTRICT.

W. C. HYDE, Orchard Instructor, Nelson.

THE following reports give an account of the more important spraying experiments carried out in the Stoke district, near Nelson, during the 1919-20 season:—

I. CONTROL OF BROWN-ROT FUNGUS IN STONE-FRUIT TREES: SELF-BOILED LIME-SULPHUR *versus* LIME-SULPHUR WITH ADDITIONAL MILK-OF-LIME.

This experiment was carried out in the orchard of Mr. T. C. C. Scott, Stoke, on a large block of stone-fruit trees, including peaches—Triumph, Kia Ora, Kalamazoo, Elberta; nectarines—Cardinal, Hunt's Tawny, Lee's Seedling; plums—October Purple and Giant Prune.

Spraying over the whole area was as follows:—

August 19: When the peach-buds were moving and green tips were showing in the plum-trees, bordeaux, 8-6-40.

September 2: When the peaches and nectarines were commencing to blossom, bordeaux, 3-4-40.

For later spraying the block of trees was divided into two sections, A and B.

October 28: "A" section received lime-sulphur, 1-120, plus the milk from 6 lb. of quicklime. "B" received self-boiled lime-sulphur, 8-8-50.

December 5: These respective applications were repeated.

January 10: The whole area received lime-sulphur, 1-120, with milk of extra lime plus tobacco-extract. No later applications of spray were made.

Although the season was rather bad for leaf-curl generally, there was none of this fungus on the experiment block.

The earlier peaches on both sections were very satisfactory; the losses from brown-rot were practically nil. While Kalamazoo peaches in these sections suffered less than 1 per cent. loss, some crops of this variety in the locality were so badly affected as to be not worth marketing. There was moderate infection in the Cardinal and Hunt's Tawny nectarines and Giant Prune, while Lee's Seedling nectarines were badly infected. Late peaches generally were troublesome, and brown-rot gave a good deal of trouble after this later fruit was consigned.

On the main issue—namely, the respective merits of the two sprays—there was little to choose. During the early part of the season they were equally effective, and at time of writing the majority of the trees

on both sections are in excellent condition with an abundant supply of well-ripened wood. Careful comparison of these tests ended in the verdict of equal merit. The lime-sulphur plus milk-of-lime spray has the advantage of being a standard summer spray for pip-fruits generally.

Other points indicated by this experiment are: (1.) Lee's Seedling nectarine is very subject to the attacks of brown-rot—the grower has decided to take out the trees of this variety. (2.) More spraying is required for main crop and late sorts of nectarines and peaches. Packing the crop for spread delivery and export, together with a considerable rainfall, made extra spraying rather a difficult matter; but it is recognized that a couple of extra applications on the later sorts of peaches, as suggested above, are a necessity and well worth while.

2. CONTROL OF LEAF-HOPPER.

This experiment (co-operative) was carried out in the orchard of Mr. O. H. Taplin, at Wakatu. During the previous season leaf-hopper had been very bad in the orchard, particularly in the trees growing near a quick hedge.

A block of forty apple-trees by the quick hedge was sprayed on 7th November with Blackleaf 40 at 1-800 strength. Just previously they had been sprayed with lime-sulphur and arsenate of lead. On 28th November the whole of the orchard (with the exception of some young Sturmer trees) was sprayed with lime-sulphur 1 gallon, arsenate of lead 3 lb., and Blackleaf 1 pint to 100 gallons water. This was repeated on 23rd December. When inspected at this time the block of trees sprayed on 7th November was free from this insect, in spite of the fact that the hedge close by was badly infected. The remainder of the orchard was only slightly infected, except the unsprayed Sturmers, which were decidedly worse.

The last spray was repeated on 2nd February, and an application on the Sturmers only was made on 5th March.

In April there was a fair amount of leaf-hopper on some trees, but nowhere was it serious. The block of trees which had received the first application was decidedly cleaner than the remainder. The experiment indicates that if tobacco-extract were used with the early calyx-spray, and afterwards as necessary, this insect would be kept under control. By this means the first hatch is caught in the nymph stage.

[NOTE BY DIRECTOR, HORTICULTURE DIVISION. — Excellent results were secured in Canterbury by using lime-sulphur, 1-80, at the fruit-set period, in addition to later sprays mentioned in this report.]

3. CONTROL OF BLACK-SPOT FUNGUS.

This demonstration was carried out by the Stoke Fruitgrowers' Association in co-operation with the Horticulture Division, in the orchard of Mr. A. Gilbert, Stoke. The trees consisted of a block of pears, including the varieties Williams' Bon Chrétien, P. Barry, and Winter Nelis.

On 4th September, when the buds on some varieties were just beginning to move, bordeaux, 8-6-40, was applied; on 21st September, when the blossoms were breaking, bordeaux, 6-4-50; on 9th-17th October,

bordeaux, 3-4-40, the fruit having then set. This application was repeated on 1st-13th November.

On 27th November lime-sulphur 25°, 1-100, about 1-130 standard strength, and arsenate of lead, was applied. Several applications of this mixture were subsequently made at intervals of about a fortnight. This is the standard summer spray for pip-fruits in this orchard.

The result was a very fine sample of bright fruit, with a small percentage of rejects. The fruit was practically free of black-spot right through the block. In previous seasons the bulk of the crop was unsaleable.

Club-root Contagion.—An interesting case bearing on this subject came under my notice during the past season. A farmer put two paddocks, about 100 acres, into turnips and swedes. No. 1 had been previously cropped, but No. 2 had never previously been ploughed. No. 1 was on the higher land, and running through were two depressions which carried off all flood-water and acted as surface-drainage channels for this paddock. These channels continued through No. 2 for a considerable distance. The soft turnips in No. 1 paddock were badly affected with club-root, also the swedes in No. 2 wherever they came under the influence of the flood-water, while the roots in the rest of the field were healthy, showing that the contagion had been carried by storm-water from field No. 1 to field No. 2.—*J. W. Deem, Fields Instructor, Wanganui.*

Wild White Clover.—Replying recently to a correspondent the Biologist (Mr. A. H. Cockayne) gave the following information on this subject: Certain lines of white clover grown in the Hawke's Bay District are sold as wild white clover. Such seed is derived from long-established rye-grass pastures, and is for the most part dressed out of perennial rye-grass seed crops. In very old pastures the clover that persists is looked upon as being more or less naturally selected, the shorter-lived strains going out in the early years of the pasture. Just how far the persistence of the clover is due to reseeding and not to propagation by vegetative stools I am not prepared to say, but there can be little doubt that the clover in such permanent pastures is kept going by a certain amount of natural reseeding. It is, of course, quite reasonable to expect that such plants would undergo a process of natural selection. Nearly all imported white-clover seed is harvested from crops that have not been sown longer than two years, and there certainly have been instances in New Zealand where such seed has produced plants that do not remain permanent. I should not, however, recommend the purchase of imported wild white clover, as it is exceedingly expensive, being about £1 10s. per pound. There is no doubt that the local white clover dressed out of old-pasture rye-grass is exactly the same as European wild white, and the price is very much cheaper.

AGRICULTURAL COMPETITIONS.

SOME TARANAKI ACTIVITIES.

J. W. DEEM, Fields Instructor, Wanganui.

To the *Journal* for last September I contributed a brief account of these competitions, in the hope that it might stimulate interest and be the means of other districts taking them up. I am glad to say that several other localities between New Plymouth and Palmerston North are starting similar competitions, and from the inquiries I have had from outside my district it would appear that the idea is spreading. One may expect, therefore, that it will not be long before this most useful means of agricultural education is fairly general in all up-to-date farming districts of the Dominion.

By those who have given the question any consideration it will be recognized that in most districts there are farmers who are quite at the top of their vocation. These men are generally busy, and most of their time is taken up looking after their own farm-work; consequently they have little time to spend advising their neighbours who are not so well up in farming operations. Again, many farmers are somewhat sceptical of big returns from hearsay. Therefore any means that will spread the knowledge of the really good farmer among his less experienced neighbours in a practical and impressive manner must be of valuable service to a district. In this direction the field competition quite "fills the bill." The farmers are able to accompany the judges from field to field, see the crops for themselves, and inquire into methods of cultivation and manures. Further, as full particulars are compiled and kept, they may refer to these at any time to refresh their memories. The inspection of a good crop and obtaining all particulars as to how it was grown must be a great incentive to the indifferent farmer to improve his methods.

One of the districts in Taranaki which has recently taken up these competitions is Otakeho. Here the local branch of the Farmers' Union decided to hold competitions in the growing of lucerne, mangolds, carrots, and swedes. The members of the branch took the matter up with great enthusiasm, and the competitions were keen. The lucerne was judged at the end of January last, and the root crops in May. From fifty to sixty members of the union accompanied the judges, saw the crops judged, and entered into a general discussion on agricultural matters. The lucerne was judged on points, the awards notified before leaving each field, and a short discussion invited, so that any points in favour of or against the methods adopted on each particular farm could be gone into on the spot. The first prize in this competition was won by the oldest stand competing, and the only one that had been put down with inoculated soil. This crop had 3 cwt. of superphosphate applied at time of sowing, and was top-dressed with a further 3 cwt. per acre last spring.

The best mangold crop at Otakeho weighed $66\frac{3}{4}$ tons per acre, and the poorest $22\frac{1}{4}$ tons. In swedes the best crop was $45\frac{3}{4}$ tons, against $28\frac{1}{4}$ tons for the poorest. Points strongly emphasized were the advantage of sowing mangolds in wide drills and giving intercultivation by means of the horse-hoe. The three placed crops were sown in 28 in. drills. The advantage of early ploughing for swedes was very apparent at Otakeho, as in other districts. The winner ploughed in August, the second-prize winner in October, and the other competitors at various dates in November. The winner (Mr. Rushin), who is recognized as a good farmer, in returning thanks on being presented with the first prize, said that early ploughing and thorough cultivation had been the secret of his success. He also said that it was strange, but no less a fact, that his neighbours on the north and south were placed second and third. He thought they must have been looking over the fence.

As further emphasizing the educative value of these competitions it may be pointed out that this year members of the Toko Settlers' Association (a very active body as regards field competitions) won first and second places in the Taranaki Agricultural Society's swede acreage competition, against strong competition. Toko also won the Taranaki District swede acreage competition for the best three crops. Members of this association made eleven entries at the New Plymouth winter show, securing five firsts, five seconds, and one third.

WOOLLY-APHIS CONTROL TESTS AT PAPANUI.

G. STRATFORD, Orchard Instructor, Christchurch.

EXPERIMENTS for the control of woolly aphid during winter and summer were carried out at the Papanui Experimental Orchard during the past season. It was intended to compare results between two sprayings with red oil at strength 1-8, during June and August, and one spraying at strength 1-8 during August, but on account of the non-arrival of the spray-pump the June sprayings could not be carried out. The following are particulars of the tests and the results obtained :—

WINTER CONTROL.

1. *Red oil, 1-10, heated to 120° F.*—Four Rokewood trees badly infested with aphid were selected for this test, the spray being applied on 17th July, 1919. An examination of the trees was made on 9th October, when it was found that the results were very satisfactory, the trees being practically free from aphid. A final examination was made on 24th February, 1920. A few colonies of aphid had established themselves during the season, these being chiefly on the new growth, but the main parts of the trees were very free from infection.

2. *Red oil, 1-1, heated to 120° F. ; painted.*—Painting was done on 18th July, on Rokewoods, treating only the parts affected with aphid. Trees were examined on 9th October, and again on 24th February.

Aphis was well controlled in the parts painted, a small percentage showing round the edges of the older knots at the final examination. A good many colonies were to be found on the young shoots. One tree was painted all over with the oil at strength 1-1 heated to 120°. No apparent damage was done to any of the buds, and the tree blossomed at the usual time, setting out an average crop of fruit. At the final examination, on 24th February, this tree was practically free from aphis, very little showing in the young growths.

3. *Red oil, 1-1, cold; painted.*—Rokewoods; bad with aphis; painted 18th July, on affected parts only. Examinations on 9th October and 24th February. Aphis was considerably checked by this application, but results were not as good as when heated oil was used.

4. *Pomsol, 1-1; painted.*—Four trees slightly affected with aphis; affected parts painted 9th July. At examination on 9th October there was practically no aphis showing, but it began to appear as the season advanced, and at the final examination on 24th February the trees were considerably affected where painting had been done.

Summary.—Spraying with red oil at strength 1-10, heated to 120°, gave the best results, and in my opinion this is worthy of further tests. Painting with red oil at strength 1-1 was fairly good in control, but considering the time taken it does not compare favourably with the heated spray at 1-10. Pomsol did not appear to last on the trees as long as the red oil, and therefore was not so effective.

SUMMER CONTROL.

1. *Blackleaf 40, at strength 1-800.*—One row of apples was sprayed on 12th December, aphis showing at time of application. Examined one week after spraying; practically no aphis showing. Examined again on 11th January, when quite a number of colonies had established themselves not only on the young wood, but also on the older parts that had received attention when spraying. Trees were again sprayed on 12th January. This spraying kept the trees free from aphis for a longer period, but on examination on 24th February quite a lot of aphis was found.

2. *Blackleaf 40, plus lime-sulphur 1-120.*—Sturmiers were sprayed on 9th December, when quite a number of colonies were present. This spray was very effective, keeping the aphis in check for some time. Sprayed again 12th January. Final examination showed much aphis in all parts of the trees—more than on trees where Blackleaf 40 was used alone. There was no detrimental effect on the foliage with this spray.

3. *Pomsol, 1-40.*—One row of Sturmiers was sprayed on 28th January, there being a fair amount of aphis at time of spraying. The spray washed the aphis off where struck, but it soon returned and increased during the season. This treatment was not effective in control.

4. *Pomsol, 1-60.*—Same result as in No. 3.

Summary.—Blackleaf 40 gave the best results, keeping the aphis in check longer than other sprays used, although it was only a temporary check. There appeared to be no advantage in adding lime-sulphur to the Blackleaf. The results from using Pomsol were less satisfactory.

FARMERS' RESPONSIBILITIES WHEN GRAZING STOCK FOR REMUNERATION.

A. D. PARK, A.I.A.N.Z., Wellington.

A BAILMENT is a delivery of goods in trust on a contract expressed or implied that the trust shall be duly executed and the goods redelivered as soon as the time or use for which they were bailed shall have elapsed or be performed. The person who receives the goods is styled the bailee, and the person who delivers them the bailor. Where a bailment is for the benefit of both the bailor and the bailee the latter is liable for *ordinary negligence*, which is usually interpreted to mean the omission to take the same care as every man of common prudence takes of his own property.

A species of bailment commonly dealt with by farmers is that known as agistment, which is a contract to take in stock to graze on the farmer's own land for reward. Such contracts are as a rule entered into verbally. The person on whose land the stock are grazed has a sufficient interest in them to proceed, civilly or criminally, as the case may be, against any third person who interferes with them or takes them away. In the absence of a special agreement he has no right of lien upon them for his charges, and, moreover, he must exercise reasonable care in dealing with such stock when committed to his care, as he is liable for negligence. The amount of care required is a question of fact, and depends upon the particular circumstances of each case. No general rule is laid down as to what constitutes negligence, but, as stated above, all that can be demanded is the display of a reasonable amount of foresight so as to guard against avoidable dangers. Thus, stock would require to be properly fenced in to prevent them from straying. If the stock is stolen without any negligence on the part of the bailee he cannot be called on to bear the loss sustained.

The law in New Zealand provides that every person who drives or removes any stock from any land not in his own occupation without the consent of the occupier of such land is liable to a fine not exceeding £100, or to imprisonment for a period not exceeding twelve months (*vide* section 59 of the Stock Act, 1908). It is further provided that any Inspector of Stock may, if he thinks fit, on the application of any owner of stock who has reason to believe that any of his stock have strayed to and upon any land occupied by any other person, by notice require such occupier to muster his stock, or, in the case of not being an owner of stock, to allow such stray stock to be mustered in a yard or pen on a date to be named in such notice for the purpose of delivering over such stray stock to the owner thereof. Every such occupier who refuses or neglects to comply with any such notice from the Inspector is liable to a fine not exceeding £20 and not less than £1. The Inspector may, if he thinks fit, on the application of such occupier, postpone the time fixed in the notice for the mustering and delivering of such stock, and the occupier is entitled to recover from the owner any reasonable expenses incurred in mustering the stock or delivering stray stock, as well as compensation for any unavoidable damage caused in so doing (section 56).

In the case of a farmer who takes in stock for grazing and such stock are stolen while on his land, it would be considered his duty to notify the police or the owner, so that steps might be immediately taken for their recovery.

An interesting case—*Coldman v. Hill* (35 T.L. Rep. 146)—which illustrates this was recently heard in England. The facts were that Hill, the defendant, was a farmer who took in cattle for pasturing, and in the spring of 1917 took in some cows belonging to the plaintiff. On 6th June two of the cows were reported to him by his stockman as missing. On the following day the stockman was told that two men had been seen driving the cows away about midday on 5th June, and he reported this to the defendant. The defendant did nothing, and did not communicate the loss to the police, nor did he inform the plaintiff. He was under a belief that the plaintiff himself had taken away the cows, as he had already said he would do, but the defendant wrongly assumed that he already had done so. The cows were, in fact, stolen, and the plaintiff was not informed that his cows were missing until about three months after.

The County Court Judge, who first heard the case, held that up to the time of the theft the defendant had not been negligent, but that he was negligent in not communicating with the police or the owner when his stockman reported to him the fact that the cows were missing. The question then arose, Did this negligence lead to the loss of the cows? Usually the plaintiff has to prove the negligence he complains of, and he must also show that such negligence caused the loss. It was contended for the plaintiff that it was for the defendant to show that even if he had communicated at once with the police there was not any reasonable chance of the cows, or their value, being recovered from any one who had taken them. It makes, of course, a great difference which of the parties at law has to take up this burden, or onus of proof as it is called. The Judge found there was no reasonable doubt that when the cows were missing they would have been recovered if the defendant had communicated with the police, and he gave judgment for the plaintiff. The defendant appealed to a Divisional Court, which reversed the County Court judgment, holding that there was no evidence on which the County Court Judge could find that the cows might have been recovered, and in any case that the damages alleged to be caused by the defendant's negligence were too remote to be recovered. The plaintiff then took the case to the Court of Appeal, with the result that this Court gave the same judgment as the County Court Judge and reversed the decision of the Divisional Court, it being held that though the cattle were temporarily out of the custody of the agister (the bailee) they may not have been completely lost, and he could, by taking some step which a reasonable man would take, have restored them to his custody and so prevented the completion of the loss, and such a step it was his duty to take.

At the head of all sciences and arts, at the head of all civilization and progress, stands, not militarism, the science that kills; nor commerce, that accumulates wealth; but agriculture, the mother of all industry and the maintainer of life.—*President James A. Garfield.*

WORK FOR THE COMING MONTH.

THE ORCHARD.

REPORTS relative to the fruit shipped to England during the month of April last indicate that the whole of the shipments, with the exception of the first small consignment of pears, arrived in good condition, were well received and commented upon by buyers, and brought top control prices. This should secure to shippers very reasonable net returns per case.

In the circumstances it is a great pity that more was not made of the opportunity to export. Had this been done many of the present holders of fruit in cool storage would have correspondingly less cause to worry over future prices than they have at the present time. However, the Department, at the request of the Fruitgrowers' Federation, which was anxious, if possible, to relieve the situation here, sought information by cable from the High Commissioner, London, as to the prospects of New Zealand apples on the English markets during the months of September and October. The reply, although somewhat late for the purpose, is interesting, as follows:—

"With reference to your telegram of 8th July respecting apples: Prospects generally are regarded as good for Sturmers and Delicious arriving in September–October. English crop this season is expected to be light, and it is understood imports from America are being recommended. Food Controller has suspended price restrictions from 1st August to 14th November, so that imports and home supplies during that time will enjoy free market. New Zealand shippers should not send apples over 2½ in. or 2¾ in., and provided fruit is in good condition and arrives sound it should command present control figure. From 15th November control will be reimposed, price being based on maximum of 10d. per pound retail. Would be glad to receive early advice of intended shipments, and to learn if these will be made under usual Government guarantee of 1d. per pound."

—J. A. Campbell, Assistant Director of the Horticulture Division.

AUCKLAND.

Spraying: Peaches, nectarines, and plums should be sprayed just as buds commence to burst, with bordeaux, 8-6-40, for control of fungoid diseases, including leaf-curl, shot-hole, rust, brown-rot, and bladder-plum. It is desirable that this spray should be put on as late as possible before the blossoms actually burst.

It is possible that the cold snap experienced in July will have caused later bud-movement in pip-fruits. At any rate, it is to be expected with many varieties of apples, and in this case the dormant red-oil sprayings for control of sucking-insects which have not yet been applied may be carried out during the first week in September, where no bud-movement is noticeable, at 1-15 on apples and 1-17 on pears. Red mite on apples is rather much in evidence in the Auckland District this year, consequent upon the dryness of last summer, and on this account the oil should not be missed.

Spraying for black-spot and other fungoid diseases must receive earnest attention as the blossom-buds commence to swell, using bordeaux, 8-6-40. This must be followed in pears and all varieties of apples subject to black-spot with bordeaux, 6-4-50, at the cluster-bud stage. Many growers with as many as ten to twelve varieties of pears and apples make one spraying suffice for each of these applications. When it is noticed that one or two, or maybe three, varieties have reached the correct stage, the whole block is sprayed then and there to "save trouble," whereas there is no surer method of inviting trouble in a pear

orchard in an average season. My experience in the Auckland District goes to show that the pear-grower who sprays each variety as those trees reach the proper stage obtains good results, amounting even in a bad season to 90 per cent. of clean fruit.

Citrus fruits : The growth of all classes of citrus fruits is somewhat irregular this year on account of the abnormal weather conditions of the past twelve months. Growers must watch the opportunity to put on bordeaux, 5-4-40, either before the early spring growth commences or when it is sufficiently hardened. If verucosis is prevalent and a good setting of fruit has been obtained, in cases where the young growth has not hardened a weaker bordeaux spray (4-4-40) may be applied as soon as blossom-petals have fallen.

Cultivation : As soon as prunings have been cleared up and early spring sprayings completed manure should be applied, and ploughing may then be proceeded with, followed by any digging that may have to be done. Owing to the present high cost of labour for orchard-work it is advisable to plough up to as near the trees as possible, using extension bridles to the plough, and orchard harness with rope or leather traces. Ploughing close in to the trees must be shallow to avoid loss from damaging feeding-roots. All ploughings should be completed before the spring growth of clovers attains its height.

Manuring : Although artificial manures are very high in price this season, neglect to apply them only results in a lesser production and eventually soil-depletion. It is bad policy to spare the manure, whatever the plant may be.

Grafting : It is usually found that some attention is required in every orchard in this respect. The work of cutting down all trees for regrafting should now be completed, and scion wood procured without delay. Grafting requires to be done when the sap is rising, in order to ensure a ready lifting of the bark-tissues and an immediate flow of the necessary sap from stump to scion. The first two weeks in September will probably be the best period for grafting this season.

---J. W. Collard, Orchard Instructor, Auckland.

HAWKE'S BAY.

All prunings should now be gathered and burned, planting finished, and the land spring-ploughed. Towards the end of the month the bark of the apple and pear will be in a pliable condition, and grafting may then be done.

Stone-fruits should be sprayed with bordeaux, 8-6-40, for leaf-curl, pocket-plum, rust, &c., as the buds are bursting. Black aphid may be controlled with Blackleaf 40, $\frac{1}{2}$ pint to 50 gallons, with $1\frac{1}{2}$ lb. of soap as an adhesive.

For the treatment of black-spot bordeaux is the preventive to be relied on, and must be applied at the correct stage. Though there are certain varieties which rust badly if bordeaux is applied too late, all varieties will benefit by an application if applied before open-cluster. For working convenience apples and pears should be divided into three classes and treated as follows :—(1.) Apples and pears not subject to russet : Early bud-movement, bordeaux, 8-6-40 ; early bud-movement to green-tip, oil, 1-17 ; petal-fall, bordeaux, 3-4-50. (2.) Apples and pears inclined to russet but not badly, such as Dunn's, Statesman, Cox's, Adams', and all true russet varieties : Early bud-movement, bordeaux, 8-6-40 ; early bud-movement to green-tip, oil, 1-17 ; open-cluster but no colour, bordeaux, 6-4-50. (3.) Badly russetting varieties, with tender skin, also subject to powdery mildew, such as Jonathan, Cleopatra, Sturmer, and Josephine : Early bud-movement, bordeaux, 8-6-40 ; early bud-movement to green-tip, oil, 1-17 ; open-cluster, lime-sulphur, 1-30. With class (2) the application of a second coat of bordeaux is a good safeguard and ensures the full effectiveness possible at this period without the danger of russet. With class (3) bordeaux at open-cluster is risky, and as there is powdery mildew to consider, lime-sulphur is substituted to serve a dual purpose.

Red mite : It will be noted that with the various apples and pears, regardless of the russet class, an application of oil is advised at bud-movement even as late as green-tip. At this period the maximum efficiency of control against the various insect pests is assured, while the general effect on the eggs of red mite is such that the hatching-time is retarded considerably, and the trees are safeguarded from the injurious effects of early insects at the critical time—the flowering-period. The control of red mite depends in no small measure on the orchardist becoming acquainted with the hatching-time. This varies with locality and season, so a close watch must be kept, particularly on the imperfect leaves

found on fruit-spurs throughout the lower framework of trees. Once the mites become active they can be killed with lime-sulphur, 1-100, which should be applied at frequent intervals—say, every eight days—in order to catch delayed hatchings. Control later in the season will depend a good deal on the thoroughness of these early applications, as insects escaping will deposit summer eggs to hatch out later.

—W. H. Rice, *Orchard Instructor, Hastings.*

NELSON.

Towards the end of September the apple-trees will commence to swell their buds; the pear-trees are rather earlier. The general pruning should be completed before these dates. Considering the prevalence of bitter-pit in apples, and its relation to pruning, growers are recommended to consider McAlpine's fifth report on "The Cause and Control of Bitter-pit." Mr. McAlpine considers pruning a prime factor in the problem.

Carefully label and heel-in scions for grafting later in the month, or, better still, in early October, when growth commences.

A clean crop depends chiefly on proper spraying at this season; for stone-fruit and pear-tree spraying see last month's notes. Apple-trees will require the application of a fungicide early in September, while the trees are dormant. Lime-sulphur, 1 gallon to 10 gallons water, is the popular spray at this season. Apples specially subject to black-spot are best sprayed with bordeaux, 8-6-40, instead. Trees infected with scale or aphid, &c., should have the above fungus-spray followed with an application of red oil, 1-15 or 1-20, the weaker mixture being used if the buds have commenced to swell. Lemon-trees affected with black scale should be sprayed with red oil, 1-40.

The heavier orchard lands will be ready for ploughing during September. Take the first opportunity of turning them over, carefully burying any cover-crop and disking down the slices without delay. A good job chiefly depends on doing the work when the soil is sufficiently dry; do not be tempted to start before. Use a special plough for working round the trees, and a light double-furrow implement for ploughing the centres. See last month's notes regarding liming and manuring.

An inspection of fruit cool stores at the present time is of great interest. It is said that "experience teaches," but much depends on the student, his powers of observation, and the practical application of the knowledge gained. Much of the fruit in cool stores is unsuitable for long storage. Considering present-day costs it is unwise to store the larger-sized apples—dessert varieties over 2½ in.—particularly Jonathans. The sooner such lines are quit the better.

—W. C. Hyde, *Orchard Instructor, Nelson.*

MOTUEKA.

Spring ploughing and general cultivation should be kept well in hand. Manurial treatment where required should be attended to, and the manure turned under with the plough. All prunings should be gathered and burned.

This month will be one of the busiest, if proper attention is given to the requirements of the orchard regarding the control of disease. The main work will be the early spring sprayings for the control of fungus diseases. For the early sprays, bordeaux, 8-6-40, should be applied when the buds show colour. This spray will be found most effective for control of leaf-curl and shot-hole fungus on stone-fruits. The same strength of bordeaux applied to apples and pears when the buds are bursting will greatly assist to control black-spot. At the later pink stage (just when the blossoms show pink) bordeaux, 6-4-50, should be applied to pears.

Lime-sulphur (preferably home-made) may be used at the latter stage on apples, at a strength of 1-25 to 1-30. Lime-sulphur should be tested with an hydrometer, and when testing under 33° Beaume it should be prepared and diluted according to the table published in the Department's Bulletin No. 82, so as to make a standard strength. A copy of the bulletin is available by application to the local Orchard Instructor. Good results were obtained by many orchardists in this district last season by a continued application of lime-sulphur throughout the season, weakening the applications as the trees advanced.

Where the oil spraying for control of insect pests has not yet been applied, this should be done early in the month at a strength of 1-12.

Grafting may be undertaken towards the end of the month.

—W. T. Goodwin, *Orchard Instructor, Motueka.*

CANTERBURY.

Another reminder to gather up and burn all prunings will not be out of place, as so many growers are apt to leave these lying about for a great portion of the season, thus interfering with cultivation and also possibly acting as a source of infection to the fruit-trees. Planting of young trees should be finished in the early part of the month if good results are to be expected from the first season's growth.

Manuring, if necessary, should claim the attention of the orchardist at this time of the year, especially in cases where heavy crops are taken off the trees annually. No doubt an application of well-rotted stable manure would fill the bill better than anything, but as in the majority of cases this is unprocureable a good dressing of artificial manure will be found beneficial. Blood-and bone has proved very successful in orchards in this district, spreading it broadcast round the tree and hoeing it under the surface.

Green crops sown in the autumn will require to be ploughed under during the month, taking care to see that the entire crop is buried. It is advisable to leave any further cultivation for a time, thus giving the green crop turned under a chance to rot. Spring ploughing should be done as soon as possible. Much of the success of the orchard depends on the condition of the soil at this time of the year; therefore it is advisable to give every attention. Break down the ploughing by means of the cultivator or harrows, and so reduce the soil to the fine tilth necessary for conserving the moisture throughout the season.

As stated last month, spraying will be the chief work of the orchardist at this season, and the recommendations given still apply. The mixing of sprays is most important, especially when using bordeaux, the real efficiency of the spray depending on the manner of blending. Much also depends on the time of application. The different varieties in the orchard are not all ready for a certain spray at the same time, therefore trees should be studied and watched as regards spraying right from the bud-movement period, and the different sprays for different periods applied at the proper time. Spraying done at the wrong time might just as well be left undone, as it only results in a waste of good material.

—G. Stratford, Orchard Instructor, Christchurch.

OTAGO.

In last month's notes the sprays for insect pests and also for the fungus diseases of stone-fruits were dealt with. The next consideration is the sprays for fungus diseases on pip-fruits—black-spot of the pear and apple, and powdery mildew of the apple. The former disease does not yet concern Otago Central growers, but the Teviot district is slightly troubled with it, and the disease gets worse in the lower country where the rainfall becomes greater. The past season was a comparatively good one, black-spot causing very little trouble except in odd instances, but growers must not relax their efforts. Bordeaux is the best preventive for this disease, and is best applied when the blossom-buds have just emerged but are not yet showing pink, at 6-4-40; and again in the pink stage, 3-4-40, about a week to ten days later, bearing in mind that all varieties do not blossom together, and that to get the maximum results each variety must be treated as the right stage is reached. When the blossoms are showing pink the mixture must be reduced to 3-4-40, and tested with litmus paper to make sure it is a neutral mixture not showing any acid reaction. Be sure the lime is fresh slaked, and do not allow the bloom to get too forward.

The foregoing remedy is the best for pears, but the varieties of apples must be taken into consideration because of the susceptibility of some to russetting. The following varieties are very liable to russet and crack with the two applications of bordeaux given above, and should not receive the mixture after the early stage: Adams' Pearmain, Jonathan, Gravenstein, Ribston Pippin, Cornish Aromatic, Sturmer, Scarlet Nonpareil, Shepherd's Perfection, Dunn's, and Cox's Orange. These should receive lime-sulphur, 1-50, at the pink stage in preference to the second application of bordeaux. The four last-named are the better for lime-sulphur treatment at both stages, first at 1-20, and secondly at 1-50. For powdery mildew lime-sulphur is the best remedy, and the disease must be tackled early, first at green-tip stage, 1-10, followed at early pink stage, 1-30, if delayed, reducing to 1-40-50 as blossoming advances. All mildewed tips should be cut off and burned when noticed on the trees. All subsequent sprayings will be confined to sulphur compounds, particulars of which will be dealt with in future notes.

Growers desirous of regrafting apple-trees will find the second week in September the best time to do this. Stone-fruits must be done fully a month earlier than pip-fruits. These dates apply to Central Otago; the Taieri district will be quite three weeks in advance. Test the stocks to be regrafted, and insert the scions as soon as the bark parts freely from the stock.

—J. H. Thorp, Orchard Instructor, Dunedin.

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

HATCHING FOR PROFIT.

As September is the best month for hatching out the popular White Leghorn it is obviously the period in which the great bulk of incubating and brooder work must be carried out. While this is mentioned as the most desirable time for the White Leghorn, or indeed any of the lighter breeds, there is no objection to continuing the hatching during the early part of October; the end of September, however, is certainly better. The greatest drawback in prolonging the hatching-period is that too many late-hatched pullets are produced, and those seldom lay in the winter, and are therefore not profitable stock. The wise poultry-keeper aims at securing all his chickens during two months—August and September—instead of extending it over a period of about six months, which is often the case. It is not sufficient to have only a proportion of the pullets laying when eggs are worth most money. The great majority of the pullets must be producing dear eggs if the true profits are to be secured from the business. It should be remembered that one egg in winter is worth more than two in summer, and it is the early-hatched pullet that produces the dear egg. No time therefore should be lost in getting the full complement of chicks hatched out.

Unfortunately, many who depend on the natural mother are forced to hatch late owing to their inability to secure broody hens. One means available to the small poultry-keeper for overcoming this difficulty in timely hatching is the present facility for securing day-old chicks from reliable specialists in the production of heavy-producing stock. Such chicks can be satisfactorily brought to maturity with a fireless brooder, provided the necessary attention is available.

BROODING-POINTS.

In artificial rearing the importance of preventing the chickens from being chilled cannot be emphasized too strongly. The most common cause of chill is subjecting the chick to extremes of temperatures. It is therefore essential that they be carefully watched in order that the degree of warmth shall be at all times favourable to their development. As to the temperature to be maintained in the brooder, there is no better guide than the behaviour of the chicks. If they be well spread out and look comfortable it may be taken for granted that the heat being maintained is correct. On the other hand, if they are seen to be huddling more warmth is required; while if the heat be too great they will be gasping for breath, with wings spread out to a lesser or greater degree, and thus when they leave the brooder they are highly susceptible to chill.

In addition to having the right degree of warmth, the brooder must be arranged in such a way that pure fresh air is available to the chicks at all times. Stuffiness must never be allowed to exist, or the mortality will be great. An experienced person can tell at a glance by the appearance of chicks when they leave the brooder in the morning if the ventilation is sufficient or not. If it is observed that the youngsters come out bright and active and are keen to exercise it indicates that sufficient fresh air is available. On the other hand, if they come out dull, and brighten up during the day, it may be taken for granted that the night conditions are not what they should be and that more fresh air is necessary. No matter whether it be with a heated or fireless brooder, the provision for the admittance of an ample supply of fresh air is an all-important essential.

Do not be in a hurry to feed the chicks after they are first placed in the brooder. Plenty of sleep and a comfortable degree of warmth is of more importance than food. As to feeding, some breeders prefer giving all wet mash, while others feed a mixture of dry broken grains. Both systems have their advantages, and what to feed largely depends on circumstances. Where the broken grain is used better results will be secured if it is moistened and allowed to swell before being feed, particularly with young chicks.

Do not neglect to pay strict attention to cleanliness in all things connected with brooding operations. The brooder must be frequently cleaned, and it should be sprayed with disinfectant before a fresh lot of chicks is placed in it.

After the chicks are three days old they should not be permitted to acquire the habit of remaining too long in the brooder during the day. On the contrary, they must be induced to exercise as much as possible, for the great value of exercise for promoting health in chicks cannot be overestimated. A good plan is to lightly cover the brooder-runs with straw chaff, and scatter in this some finely broken grains. Hulled oats make a fine scratching-food, and there is nothing better for promoting a healthy growth in chickens of all ages.

Always open up any chicken that dies, in order to discover if possible the cause of death. Recently I was asked to advise in a case of continual deaths of chickens, and, on examination, observed that the gizzard was packed with small pieces of shiny grit, which they could not get rid of, and therefore died of starvation. On my advice sea-shell was used for grit with the next lot of chickens hatched. Now I am informed that the chicks could not be doing better. This indicates that grit containing small shiny particles should not be used for very young chicks. Much mortality among chickens also takes place through their eating pieces of fibrous green material, which also blocks the gizzard. All green stuff for chickens should be fed fresh and tender and be cut up fine. The feeding of green material, such as grass of undesirable length, is specially bad where no grit is fed with it. Providing it is of the right quality, grit should be mixed with the first few meals a chicken receives. After then it should be placed in a shallow dish and left for the chick to pick at when required. Charcoal is another necessity, if bowel trouble is to be kept in check. It should be fed in a similar manner to grit.

Chicken-rearing is a business of little details, and if these are not observed in every respect the best results cannot possibly be achieved.

THE IMPROVED FIRELESS BROODER.

In my description of this brooder in last month's *Journal* it was stated (p. 36, second paragraph) that the fresh air enters through the openings in the front board, and passes out at the back of the hover, where there is a space of about 1 in. by $\frac{3}{4}$ in. This was a typist's error for $1\frac{1}{2}$ in. The correct space, however (between the hover-frame and the brooder-box), is 2 in.

THE APIARY.

G. V. WESTBROOKE, Apiary Instructor.

EVERY advantage should now be taken of fine days to make a thorough examination of each hive in the apiary. At this time the bees are usually very busy gathering nectar and pollen from the early-flowering shrubs and fruit-trees. During such times, when the weather is fine, very little smoke is required, for the bees being fully occupied do not resent interference as they do when there is little to gather. It is not advisable to use much smoke at the entrance at any time. Two or three puffs of the smoker should be sufficient for most hives. Then on removing the hive-cover give a few more puffs as the mat is being removed. Cloth or sack mats are an advantage in this respect, as one corner can be gently lifted and the bees smoked as it is removed.

It will be found that old dry sacking is the best fuel to use in the smoker. Care should always be taken to see that a plentiful supply of fuel is handy, and that the smoker is alight before commencing operations. The smoker is perhaps

the beekeeper's most useful tool, and too little care is often taken to see that it is in good working-order. Frequent attention to the nozzle and the small outlet in the bellows is necessary to enable it to work freely, as they are very apt to become choked with dirt and carbon. Nothing irritates the bees more quickly than to start puffing on them with a smoker that is not alight and smoking freely.

When examining the hives it is necessary to have a notebook or other means of recording the state of each colony. In order to do this each hive will require to be numbered. Small pieces of cardboard on which to make rough notes are useful. These can be placed under the lids, and the notes copied later into a book.

The main object of examination of hives at this time of the year is to ascertain the exact condition of each colony, so as to remedy as far as possible any defects that may be found. The first care of the beekeeper is usually to mentally note the number of frames the bees are covering. Then on removing each frame he carefully examines the brood to see if the dreaded disease foul-brood is present. Should he be unfortunate enough to find it he should immediately close up the hive and mark it for treatment as early as possible.

FOUL-BROOD.

The method of detecting and the treatment for foul-brood has frequently been described, but as it is important that every beginner should be able to recognize the disease when present it may be advisable to again publish this information. The following is the method of detecting and treatment recommended by the Department:—

Detection.—Healthy brood in the larva stage—that is, before it is sealed or capped—presents a clear pearly whiteness, but when attacked, which is usually about the time of capping, it changes to a light buff, then to brown. It is, however, when the brood has been capped that the novice is better able to detect the presence of disease. In the early stage of an attack a capped cell here and there appears somewhat different from the surrounding healthy brood. Instead of the cappings or seals being bright, full, and of convex form, characteristic of healthy brood, they are of a dull blackish-brown colour, and flat or sunken, an indication that the cells contain dead pupæ. The disease rapidly spreads to surrounding cells and combs, if allowed to take its course, till finally no brood can hatch, and the colony succumbs. On opening some of the cells a thin glue-like coffee-coloured mass will be noticed, which on the insertion of a splinter of wood adheres to the point, and can be drawn rope-like for some little distance out of the cells. This is one of the most distinctive features of foul-brood prevalent in New Zealand, and where present it is considered conclusive evidence of the disease. Later on this glue-like substance dries up into the before-mentioned black scale-like body. Other symptoms are “pin-holes” and ragged perforations in the cappings of the cells and a very disagreeable smell resembling that of heated glue, which may be sometimes detected at some yards away from a badly infected hive in close weather. The characteristic odour cannot easily be detected in the earliest stages, even when an infected comb is placed close to the nose, but some slight difference can be noticed between that and healthy comb at all times.

Treatment.—The present system, commonly called the “McEvoy” treatment, when properly carried out, gives an effective cure which has been repeatedly tried with absolute success in many thousands of cases in this country. Where the disease is so far advanced as to have left few bees in the colony, then it will be safest to destroy by fire everything that has been in contact with it. “Tinkering” with such a colony would be both useless and dangerous. Treatment may be undertaken at any time of the year, providing the weather is not too cold to prevent the bees building comb. In the southern parts of the Dominion, if treating in the cold season, the bees should be put on to drawn-out combs and fed with warm syrup, or the bees put on to frames of clean honey, if procurable, and left until the spring. All operations in this connection should be carried out in the evening, when the bees are quiet. Prepare a clean hive and bottom-board, with narrow starters of comb-foundation in the frames. Remove the infected hive and stand to one side, and put the prepared one in its place, prop up the front about an inch, lay a sack near the entrance, and shake and brush the bees as quietly as possible close to the entrance. When finished remove every vestige of the infected hive away where bees cannot get at it. The combs, if not too badly infected, may be melted into wax, or, if insufficient in quantity for that purpose,

they, with their frames, had better be burned right away and the residue buried. The hive, bottom-board, and cover, if sound and worth saving, should be cleaned and thoroughly disinfected with a strong solution of carbolic acid or other disinfectant, or singed inside by fire. On the evening of the fourth day following, the necessary number of frames for the hive should be furnished with full sheets of comb-foundation, to be exchanged with those the bees have been working on. This can be done by removing the frames one at a time, shaking the bees back into the hive, and inserting the others. The comb built on the starters during the four days may be cut out and melted up, and the frames disinfected. The theory of this treatment is that during their four days' comb-building the bees use up all the infected honey contained in their honey-sacs when taken from their old hive, so that when shifted again at the end of the four days they start clean.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

ASPARAGUS: Growth will now have started; the heads may not have shown through the surface, but they have begun to move underground. This is the best time to plant, as the plants start growth at once, consequently there is no loss of roots, which is almost sure to occur with early planting, resulting in weakened plants. There should be no delay now, and the roots should be exposed to air as little as possible during the operation. When the plants are lifted they should be placed between damp sacking for conveyance to the planting-ground. Everything should be ready for planting and the operation completed as quickly as possible. Planting methods have recently been described. Established beds may now be given a dressing of nitrate of soda, 1 oz. per square yard. Where old-fashioned beds exist, and these have been stripped of the top soil and a layer of manure laid on, the soil should now be returned. It is best to keep the soil off as long as possible. The manure decomposes best when exposed to the nitrifying effects of the air, and, more important still, if the soil is thrown up too early it gives weeds time to grow before the asparagus starts, involving needless work in weeding or the expense of treating them. Where weeds are present in troublesome numbers they can be killed by a dressing of salt; about 4 oz. per square yard will usually suffice.

Onions: In most places these are well started by now. The hoe or cultivator should be used as frequently as possible, so as to keep the surface open. The plants will not thrive if the surface soil becomes close, as air is necessary. Nitrate of soda is very beneficial to onions, but should not be given until transplanted sets have commenced new growth, and in the case of sown beds not until thinning has been done. If applied to unthinned rows the accelerated growth is likely to draw the plants up and make thinning difficult, besides which the crowded plants are made weak when separated. Where they are grown for salading it is suitable to apply the nitrate to the unthinned rows.

Celery: In places where the climate is of a medium order it is customary to sow in the open ground for the main and late crops, the sowing being made about the middle of September. This saves a good deal of labour, as against raising the plants in boxes. The latter must, however, be done in extra warm places where the surface soil dries out so quickly as to make it practically impossible to raise the plants in the open air. Early-sown batches will be ready for pricking off, which should be done as soon as the plants can be handled. Boxes about 2½ in. deep inside should be half filled with fairly fresh stable manure; press the manure down tight, then fill the boxes heaped up with a compost of good soil with about one-third well-decomposed manure; stroke off level with a piece of batten, press the soil firm with a dry brick or piece of board, and prick the plants out about 2 in. apart. Water well, and shade for a few days. Sprinkle the plants with clean water several times every fine day. Watering should be carefully attended to; never allow the soil to become dry. If this happens the plants are

sure to be attacked by aphids, thrips, or red spider. Where celery-rust is prevalent the plants should be frequently sprayed with 2-2-40 bordeaux, beginning while the plants are in the seed-boxes, repeating every ten or twelve days until the plants are set out in the trenches, and after that sufficiently often to keep the plants covered with the mixture practically the whole time.

Cabbages and cauliflowers should now be growing freely. If growth is not altogether satisfactory give a dressing of nitrate of soda, $\frac{1}{2}$ to 1 oz. per square yard, repeating the application five or six weeks later. New sowings may be made at once to provide heads during February and March.

Rhubarb: Good establishment of the summer variety is frequently prevented by taking the stalks for use during the first season. This should not be done. The first season all the growth made should be allowed to remain and die down on the plants. A good crop can then be had the following season, and not otherwise. A mulch of stable or farmyard manure applied when hot weather begins will materially assist growth.

Winter rhubarb: I believe the best results are obtained by raising the plants from seed, which may be sown during September or October in warm places. The seed may be sown in drills 12 in. apart, dropping two or three seeds at intervals of 12 in. Some thinning will be necessary, and will be advised on later.

Celeriac: This vegetable, known as turnip-rooted celery, is deserving of more extensive culture. The part of the plant used is the swollen root, a formation somewhat like the swollen stem of kohlrabi, with the difference that the stem protuberance of celeriac is beneath the surface of the soil. It can be boiled as a vegetable or used in soup. The flavour is identical with celery-root, and is much liked by those who use it. The cultivation is the same as for celery, except that trenches are not required.

Leeks: Seed should be sown during the first two weeks in September, in shallow drills for transplanting.

Tomatoes: Seed should be sown during the last week in August.

Carrots and parsnips: In the cold parts of the Dominion the main sowing should be made about 15th September. In the warmer districts the first week in November is early enough.

Red beet: A turnip-rooted variety may be sown at once for first use; the long varieties are best for winter use. The times mentioned for carrots and parsnips are suitable for beet. Any one wishing to make one sowing answer for both early and late use should grow Henderson's non-bleeding beet. This variety grows rather large, but can be cut asunder before being cooked and will retain good colour; its quality is excellent.

Turnips: During the spring and summer months turnips do not stand long. Sow comparatively small lots at intervals of seven or eight weeks.

Peas: Sow at intervals of about fifteen days.

Lettuces: Sow in drills, the plants to be thinned instead of transplanting.

Radishes: Sow in small lots every ten or twelve days.

Potatoes: Early crops should be well up by now. Keep the soil well cultivated, and mould up little by little as growth is made. This provides some protection against late frosts. Main-crop planting should be done about the middle of next month in the warmer parts where summer droughts are experienced, so as to secure a good start before dry weather sets in.

Inquirers have asked for information about a mixture for dipping the sets as a preventive of disease. It should be distinctly understood that dipping cannot possibly have any effect on blight, which either comes from diseased tubers, in which case the disease is inside the latter, or from wind-borne spores which attack the haulm. Cases have been known of serious loss from dipping, this having injured the eyes, the sets failing to grow.

Starlings and Fruit.—The *Agricultural Gazette of New South Wales* states that a number of starlings were recently shot at the Bathurst Experimental Farm orchard, and the contents of their stomachs examined. These showed both grass-seed and apple-flesh, the latter predominating.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

LINSEED-CULTURE.

E. J. H., CRICKLEWOOD, South Canterbury :—

I am thinking of putting in some linseed, and should be glad of advice as to the best time to sow it, the cultivation required, and the depth and width between drills. Does it need to be dead-ripe before cutting, and is it easily shaken out?

The Fields Instruction Branch :—

The time to sow linseed is when danger of severe frosts is past. Seed at the rate of from 20 lb. to 30 lb. per acre, sowing through every coulter of the drill to a depth of from 1 in. to 1½ in. Heavy land will give the best results, but if the rainfall is well distributed the lighter lands often give good results. If your land is of good quality it should not be necessary to apply fertilizers, but if it appears to be in any way deficient in quality drill in at time of seeding 1½ cwt. per acre of basic superphosphate. In an ordinary year a linseed crop should be ready to cut for seed in from sixteen to eighteen weeks from time of sowing. It should be cut for seed when the field is turning brown, as if left to become dead-ripe the loss of seed would be considerable, especially if warm weather conditions prevailed.

SYRINGING COWS AGAINST ABORTION.

J. H. D., Spring Creek :—

Would the syringing-out of cows when they are from five to six months in calf aid towards the prevention of abortion in the seventh and eighth months of pregnancy? If so, what is the best mixture to use?

The Live-stock Division :—

The syringing-out of your cows as suggested would certainly aid towards the prevention of abortion. Great care, however, would have to be exercised in the selection and use of an agent for your purpose. A solution of the perchloride of mercury (1-5,000) should be sufficiently strong. Obtain a dozen tablets from your chemist. One tablet in 2 quarts of water that has been previously boiled would give you the required strength. The external genitals, the tails, &c., should be wiped over with a cloth wrung out in a disinfecting solution every day.

SUNFLOWER-CULTURE.

H. S., Timaru :—

I should be glad of your advice regarding sunflower-culture.

The Horticulture Division :—

The sunflower, if it does well, is a gross-growing plant. It therefore requires good soil, and even if the soil is in good heart an addition of fertilizers would be beneficial. You are advised to apply 2 oz. superphosphate, 1 oz. sulphate of potash, and 1 oz. sulphate of ammonia, each per square yard. The variety recommended is the Russian. In the warmer parts of the Dominion seed may be sown in the open ground with as good effect as if raised otherwise. In your climate it would doubtless be best to raise the plants under glass, sowing near the end of August and planting out early in November, thus obtaining a longer growing

season than would be obtained by direct seeding. Plant in rows about 28 in. apart and 15 in. apart in the rows. The heads should be ready for harvesting during March. Cut them with a few inches of stem, and hang them in a dry, airy shed with canvas spread beneath to catch falling seeds. When the heads are thoroughly dry the seed is easily shaken out.

GROWING TURNIPS FOR SEED.

"FARMER," Riversdale :—

I intend sowing turnips for seed this year, and shall be glad of advice as to the best time to sow and the seeding required. If sown in early spring would they be ready to cut in the autumn? Will the ordinary turnip-machine be sufficient?

The Fields Instruction Branch :—

It is very doubtful whether an early-spring-sown crop could be harvested for seed in the autumn, hence instead of sowing in the spring we would suggest late summer sowing—say, in February or even later—using 4 lb. to 8 lb. of seed and sowing in rows 7 in. to 14 in. apart. This would allow of considerable thinning-out of roots which are not true to type. You will also need to take precautions that other varieties of turnips are not flowering in the vicinity, otherwise there will be a great danger of crossing. For a full discussion on turnip-seed growing you are referred to the articles in the *Journal* for June, 1918, and November, 1919. It may be mentioned that merchants report that supplies of turnip-seed are freely coming to hand from Europe, this indicating that the war-period shortage no longer exists.

ARSENIC SPRAYING FOR KILLING BLACKBERRY.

"POISON," Opoutama :—

Can you inform me of the best way to mix arsenic for poisoning blackberries? How many gallons of water are required to each pound of arsenic? Is caustic or washing soda the better solvent? Is it advisable to use a copper boiler for mixing?

The Live-stock Division :—

So far a reliable specific for killing blackberry has not been discovered, though good results have been obtained on some lands by spraying heavily with a mixture consisting of 3 lb. arsenic and 2 lb. caustic soda. Dissolve in 3 gallons of boiling water, and add 8 gallons of cold water to each gallon of the mixture. Quantities can be increased by using larger supplies of the arsenic and soda in above proportion if required. Stock requires to be kept off the treated area for at least two weeks. The withered blackberry can then be burnt, and after burning an application of the arsenic mixture should be applied to the roots if at all possible. The mixture is best made in kerosene or petrol tins, which can be destroyed afterwards.

TRANSFERRING WILD BEES TO HIVE.

"SUBSCRIBER," Pahiatua :—

Would you kindly inform me if it is possible to transfer a hive of wild bees, and, if so, the best method and time for doing so?

The Horticulture Division :—

The best time to transfer wild bees to a frame-hive is in October, when a honey-flow may be expected. Have the frame-hive in readiness with the frames fitted with full sheets of foundation, and locate it as near as possible to the wild colony, with the entrance facing the same way. Next smoke the bees with a bee-smoker to quieten them, and proceed to uncover the combs, when they may be cut out and the bees brushed into the new hive. If there is no disease present the brood may be tied with string into one or two empty combs, which will have the effect of inducing the bees to adopt the new hive. Care must be taken to transfer the queen, otherwise the bees will not stay. When all the bees have settled for the evening the hive may be removed to its permanent location.

GROWTH ON MARE'S SHOULDER.

"PLOUGHIE," Featherston :—

I have a draught mare that is continually getting a soft lump on her shoulder during plough-work. As a rule the lump forms after ten to twenty-one days' work, but sometimes sooner. It is about the size of half an orange, and the top gets raw without any discharge being apparent. I have tried cutting a hole in the collar, and used gall-cures without success. The mare is practically idle during the time I need her most. Would you kindly advise treatment?

The Live-stock Division :—

The lump on the mare's shoulder will be likely to recur until some radical means are adopted for its removal. Fomentations, poultices, and blisters are of little or no value in a case of this sort. The animal should be "spelled" till the growth has contracted as much as possible and attained a definite shape and uniform hardness. A slit should then be made over the growth, and the growth secured with a needle and strong twine and dissected out. No further treatment, except a daily washing with some mild disinfecting solution, is necessary. The animal may be worked when the wound is thoroughly healed.

RYE-CORN FOR FOWLS.

"CLACTON," Canterbury :—

I have land suitable for growing rye-corn but unsuitable for wheat or oats. Would it be profitable under the circumstances to feed rye-corn to fowls? What is the feeding-value of rye-corn as compared with wheat and oats?

The Chief Poultry Instructor :—

It would probably not pay you to grow rye-corn for your fowls. In the first place it is low in food value as compared with wheat or oats, and secondly it is a difficult matter to make fowls eat it, except when forced to by hunger. Obviously, in view of this, its use will not tend to promote heavy egg-production.

SHORTENING DOG'S TUSKS.

H. S. STRATFORD, Pelorus Sound :—

We have a dog that bites the sheep, and are considering the removal of his tusks. Is this advisable, and how is it done?

The Live-stock Division :—

The entire removal of the tusks is not necessary. About $\frac{1}{2}$ in. would be enough, and the method of removal is as follows: File round the teeth at the desired spot with a sharp fine file, going well into the enamel. Apply pressure now with a pair of sharp pincers or forceps, and the tooth will break at the file-mark. Dress over any broken edge with the file, and treat the other tusk in a similar manner.

SEPTIC-TANKS AND DISINFECTANTS.

"SEPTIC TANK," Pahiatua :—

My house has its own septic-tank to which all drainage, including that of a water-closet, is led. The effluent, which I understand should be practically pure water, occasionally develops bad smells in hot weather. I am told that the last occupant of the house, with the best of intentions, frequently used to sluice out the sinks with sheep-dip. Would that prevent bacterial action in the tank and account for putrefaction of the effluent? If so, will the matter remedy itself in time, or should fresh bacteria be added from a septic-tank in good order?

The Officer in Charge, Wallaceville Laboratory :—

Provided there is no structural defect in the tank, there is little doubt that the trouble arises from the practice you mention as followed by the previous occupier. On no account should disinfectants of any kind be allowed to enter a septic-tank. Strong alkaline solutions, such as washing-soda, will also deleteriously affect the

bacterial activity upon which the function of the tank depends. It is probable that the bad effects will wear off as the properties of the disinfectant used become exhausted, but the time for this would be very indefinite. The tank might be cleaned out and examined for any leaks, &c., and a fresh start made. It is not necessary to add bacteria to the tank. These are present in sewage, and, given the special conditions necessary for their multiplication, will effectually dispose of the contents of the tank.

SHYNESS OF BREEDING IN SOW.

D. A., Whangarei :—

I have a boar and sow both in good condition, not fat, and occupying separate sties, with a run on grass on alternate days. The sow has had one litter of pigs to the boar, and has since been on heat several times, at which period they were put together, but is not yet in pig. Can you advise anything?

The Live-stock Division :—

It is possible that you may have been a little late in turning the sow in with the boar. The heat period lasts usually about three days, repeating itself every twenty-one days. It often occurs that, having given a sow a rest after weaning her pigs, one is confronted with the difficulty of getting her to breed again. This shyness of breeding may be reduced considerably by feeding on concentrated rather than bulky food. For instance, a few beans or peas, maize, or barley would prove far more suitable food for a sow about to be put to a boar than a large quantity of sloppy and unnutritious food. It would be advisable to let the sow and boar run together, feed the sow on the food mentioned, and watch carefully for results.

RATSTAIL-GRASS.

G. W., Anatimo, Nelson :—

I should be pleased to have your opinion regarding rat-tail-grass. It grows on some of the hill country here, and seems to give a lot of feed, the possessors of the country speaking well of it. It is of a tussocky nature and very tough, so that animals pasturing on it need good teeth. It will also stand firing. Is the feeding-value good enough to warrant its inclusion in seeding fern-clearings or bush-burns?

The Fields Instruction Branch :—

Rat-tail (*Sporobolus indicus*) is an inferior grass and has the power of choking out better grasses. One of its drawbacks is its very harsh herbage, which makes it useless for broken-mouthed sheep. At one time a considerable amount of seed was sown, but it is now becoming almost entirely discarded. Although it may be of some value in certain situations and circumstances, it cannot, as a rule, be recommended for seeding fern-clearings or bush-burns.

FOOT TROUBLE IN HORSE.

J. M., Waipu :—

One of my farm horses suddenly became lame, a soft lump forming behind and near the frog of the hoof. After a couple of days the lump broke and black matter bubbled out for two or three days. Recovery took place in about three weeks. I should be obliged for information as to cause and treatment.

The Live-stock Division :—

The trouble is probably due to an injury such as a nail or sharp piece of manuka penetrating the horny frog and injuring the sensitive tissues underneath; or it may be due to dirt penetrating the frog at some faulty part and setting up inflammation and suppuration. Such a case is best treated by paring the horn from the affected part, and allowing free drainage for the matter to get away. The foot should then be placed in an antiseptic foot-bath, or poulticed, until the discharge has ceased. The animal should then be shod with a leather sole. A liberal application of tar and tow to the affected part before shoeing will prove beneficial.

IMPERIAL GOVERNMENT WOOL-PURCHASE CONTRACT.

THE following statement was made by the Prime Minister, Mr. Massey, under date 28th July, in reply to a question in Parliament on the subject :—

My attention has been drawn to a statement of the 26th instant by Mr. William Milne, of Oamaru, that a very serious mistake was made in the original contract for the purchase of the New Zealand 1916-17 wool-clip and perpetuated in the contracts entered into for the purchase of the 1917-18, 1918-19, and 1919-20 clips.

I was in England at the time the original contract was entered into, and was in close touch with all the proceedings, and the cables to and from the Imperial Government passed through my hands. Mr. Milne states that the Imperial Government's offer was a cash advance of 55 per cent. over the net proceeds in London, less 1½d. per pound for freight and expenses, plus half-profits on wool not used for military purposes. The first offer by the Imperial Government was to purchase the New Zealand wool-clip at an increase of 45 per cent. on the average price realized for each quality of New Zealand wool during the season 1913-14, all charges from delivery to broker's store to be paid by the Imperial Government, and half any profits made on the sale of New Zealand wool for other than military purposes to be returned to growers, any loss to be borne by the Imperial Government. The counter-offer of the Conference of New Zealand Wool-growers, sitting in Wellington on the 14th and 15th November, 1916, and transmitted to the Imperial Government, was that the offer of 45 per cent. increase on merino wool was accepted, but other classes to be purchased on the basis of the average sale prices in New Zealand in January, 1916, estimated to be as follows: Super, half-bred, 1s. 7½d.; medium to good half-bred, 1s. 5d.; inferior half-bred, 1s. 2d.; super crossbred, 1s. 6½d.; medium to good crossbred, 1s. 4½d.; inferior crossbred, 1s. 1½d.; Lincoln and Leicester, 1s. 3½d.; lambs, good, 1s. 4½d.; lambs, inferior, 1s. 1½d. The Imperial Government returned with an offer of an increase to 55 per cent. on the average price realized for each quality of New Zealand wool during the season 1913-14. The second Conference of New Zealand Wool-growers, held in Wellington on the 22nd November, 1916-17, agreed to accept this offer, provided it was based on the following figures to be taken as the average for 1913-14: Superior merino combing, 1s. to 1s. 2½d., plus 55 per cent., 1s. 6½d. to 1s. 10½d.; medium to good merino combing, 9½d. to 11½d., plus 55 per cent., 1s. 3½d. to 1s. 5½d.; inferior merino, 8½d. to 9½d., plus 55 per cent., 1s. 1½d. to 1s. 2½d.; superior half-bred, 1s. to 1s. 2d., plus 55 per cent., 1s. 6½d. to 1s. 9½d.; medium to good half-bred, 9½d. to 1s., plus 55 per cent., 1s. 3½d. to 1s. 6½d.; inferior half-bred, 9d. to 10d., plus 55 per cent., 1s. 2d. to 1s. 3½d.; superior crossbred, 10½d. to 1s., plus 55 per cent., 1s. 4½d. to 1s. 6½d.; medium to good crossbred, 9d. to 11d., plus 55 per cent., 1s. 2d. to 1s. 5d.; inferior crossbred, 7½d. to 9d., plus 55 per cent., 11½d. to 1s. 2d.; Lincoln and Leicester, 8½d. to 10½d., plus 55 per cent., 1s. 1½d. to 1s. 4½d.; lambs, good, 11d. to 1s. 1d., plus 55 per cent., 1s. 5d. to 1s. 8½d.; lambs, medium, 9d. to 10½d., plus 55 per cent., 1s. 2d. to 1s. 4½d. This basis was agreed to by the Imperial Government.

The contract for the purchase of the 1916-17 clip was later extended, with the approval of wool-growers, to cover all wool clipped up to the 30th June, 1920, but in the arrangement for the purchase of the 1918-19 and 1919-20 clips I was able to secure a very important concession from the Imperial Government under which an amount will be returned to New Zealand wool-growers as surplus profits on this wool at the same rate per pound as is returned to Australian wool-growers, provided same does not exceed 100 per cent. of the profit actually made on these New Zealand clips.

The arrangement for the purchase of freezing companies' shipe wool produced up to the 30th June, 1917, was 55 per cent. on the average price per pound received from each and every grade produced by each company and sold in London between the 1st January and the 31st December, 1914, less 1½d. per pound, representing shipping expenses, freight, and other charges. After the 30th June, 1917, freezing companies' shipe wool to be purchased on the basis of 55 per cent. on the average realizations in London from the 1st July, 1913, to the 30th June, 1914, less 1½d. per pound. The schedule was prepared on this basis, and valuations have

been made in accordance with same. The only alteration made in 1918 in the arrangement for the purchase of freezing companies' slipe wool was that whereas wool produced to April, 1918, was valued in London, wool produced subsequently was valued in New Zealand. Under both arrangements freezing companies were required to put their wool f.o.b. at their own cost. In view of Mr. Milne's statement that the average London prices from the 1st July, 1913, to the 30th June, 1914, were very considerably higher than the basis of prices taken for the greasy clip, I may state that the clean-scoured cost of the valuation schedule for slipe wool (which is necessarily based on London prices, as all slipe wool was sold there) is lower than the clean-scoured cost of the valuation schedule for the greasy clip.

IMPORTATION OF FERTILIZERS: JUNE QUARTER, 1920.

FOLLOWING are the importations of fertilizers into New Zealand for the quarter ended 30th June last, the name, quantity, and value of each kind, together with country of departure, being specified:—

Sulphate of Ammonia.—United Kingdom, 3 tons, £69; Australia, 26 tons, £1,173: total, 29 tons, £1,242.

Gypsum.—United Kingdom, 3 tons, £42; Australia, 149 tons, £360: total, 152 tons, £402.

Nitrate of Soda.—Australia, 169 tons, £4,447; Chile, 248 tons, £3,459: total, 417 tons, £7,906.

Basic Slag.—United Kingdom, 769 tons, £6,961.

Blood-and-bone.—Australia, 10 tons, £219.

Bonedust.—Australia, 905 tons, £12,427.

Char Dust (Bone Char).—Australia, 155 tons, £1,126.

Guano.—Australia, 130 tons, £595; New Caledonia, 818 tons, £4,611: total, 948 tons, £5,206.

Rock Phosphate.—Australia, 1,364 tons, £5,878; Makatea Island, 7,400 tons, £18,315: total, 8,764 tons, £24,193.

Superphosphate.—Australia, 1,277 tons, £9,262.

Other Phosphates.—Australia, 211 tons, £1,028; Egypt, 5,010 tons, £34,716; United States of America, 2 tons, £39: total, 5,223 tons, £35,783.

Kainit.—United Kingdom, 1 ton, £18; France, 120 tons, £801: total, 121 tons, £819.

Sulphate of Potash.—United Kingdom, 113 tons, £3,359; France, 20 tons, £596; Germany, 15 tons, £366: total, 148 tons, £4,321.

Sulphate of Iron.—United Kingdom, — tons, £5; Australia, 20 tons, £212: total, 20 tons, £217.

Other Fertilizers.—United Kingdom, 1 ton, £14; Australia, 29 tons, £287: total, 30 tons, £301.

NOTE.—With regard to the "declared values" which are given above, the Comptroller of Customs gives the following explanation: "The value for duty is the fair market value in the country whence the goods are imported plus 10 per cent. As the addition of 10 per cent. does not nearly cover the present freight, insurance, and other charges, the statistical value is a long way less than the actual landed value."

Whitewash.—The following makes an effective wash for the inside of loose-boxes, cowhouses, and also for outside brickwork: Take $\frac{1}{2}$ bushel unslaked lime, slack with boiling water, and cover to keep in the steam. When cool strain through a fine sieve. Add 1 peck salt dissolved in warm water (saturated); 3 lb. ground rice, boiled to a thin paste and stirred in while hot; $\frac{1}{2}$ lb. Spanish whiting; 1 lb. glue, previously dissolved by soaking in cold water, and then melted in a water bath. Dilute with 5 gallons warm water, and allow the mixture to stand a few days before using, well covered from dust. This preparation is known as "Lighthouse" whitewash.

THE FERTILIZERS ACT AND "IDEAL GRASS MANURE."

At the Magistrate's Court, Auckland, on 18th July last, Frank M. Winstone was charged with having sold a fertilizer (Ideal Grass Manure*) the analysis of which was at variance with the invoice certificate, to the prejudice of the purchaser. The information was laid on behalf of the Department of Agriculture, whose Inspector had taken the samples under the Fertilizers Act. The analysis made by the Department had disclosed a deficiency in soluble nitrogen to the extent of 0.40 per cent. out of 0.60 per cent., and 0.85 per cent. out of 2 per cent. insoluble nitrogen, supposed to be present, or 48 per cent. less than the guarantee of total nitrogen. The evidence showed that at least eight bags of the manure were sampled, and in each case the samples were taken from various portions of the contents so as to secure a fair average.

The defendant, while admitting the offence under the Act, maintained that the bulk was not deficient in the guaranteed quantity of nitrogen. He stated that at the time of the last registration the nitrogenous element was supplied by animal nitrogenous manure capable of being reduced to a fine powder. Owing to shortage in this ingredient it had later been necessary to use nitrate of soda. This was in crystal form and did not crush and mix readily with the other ingredients.

The Magistrate said he was prepared to deal with the offence as a case of an invoice made without knowledge that the goods did not comply with the certificate, but there was an obligation on the part of the vendor to make sure that the mixture was correct, the matter being a serious one for farmers. The defendant was convicted and fined £5, with costs £1 8s.

Although the point of deficiency in *insoluble* nitrogen (0.85 per cent.) was not specially referred to in the Court proceedings, it should be clearly understood that the stated imperfect mixing of the nitrate of soda does not account for such deficiency, the nitrogen in nitrate of soda being wholly soluble.

* The minimum composition of Ideal Grass Manure, as guaranteed by the vendor, and registered under the Fertilizers Act for the year 1919-20, was as follows: Nitrogen—soluble 0.60 per cent., insoluble 2 per cent.; phosphoric acid—soluble *nil*, insoluble 17.84 per cent.; potash, *nil*. See Serial No. 193, in list of fertilizers published in *Journal* for July, 1919, page 45.

LAND FOR RETURNED SOLDIERS.

DURING the month of July an area of 18,028 acres was made available for selection by discharged soldiers. This area was subdivided into thirty-nine holdings, and mainly consisted of good dairying and grazing country. One pastoral run of 3,500 acres is included in the area.

During the month of August a total area of 60,545 acres is available for selection, and is subdivided into 151 holdings. Included in this area are three small grazing-runs of a total area of 5,645 acres, situated in the Nelson Land District. Several large blocks of Crown land in the Auckland Land District are made available; the areas of these sections range from 114 acres to 2,872 acres.

In the Auckland District, Orongo and Selwyn Settlements, containing a total of 756 acres, situated on the Waihou River and at Lichfield respectively, will be opened on the 17th September. Linkwaterdale Settlement, of 450 acres, in the Marlborough District, is to be opened on 7th September.

The principal blocks of Crown land to be opened in September are 2,857 acres situated near Owahango, in the Wellington Land District, consisting of partly cleared heavy-bush land, and 2,649 acres near Murchison, in the Nelson District, consisting of heavy-bush land.

Unidentified Subscription.—A 2s. 6d. postal note, No. 686961, issued at Manukau on 5th August, 1920, together with 1s. 6d. in stamps, have been received without letter of advice. The sender should communicate name and address.



The New Zealand
Journal of Agriculture.

VOL. XXI.—No. 3.

WELLINGTON, 20TH SEPTEMBER, 1920.

SOILS OF THE MANAWATU DISTRICT.

PART III. THE LOAMS AND OTAKI SANDS.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

IN Part I of these articles the recent dune-sands, consisting almost wholly of mineral matter and crystalloid in character, were described, and in Part II an account was given of the humus soils, formed almost wholly of organic matter and chiefly colloidal in character. In this part it is intended to deal with the loams, which do not suffer from the conspicuous defects of the previous types and therefore represent the most valuable soils of the area, and the older dune-sands named by Dr. Cotton the "Otaki sand series," which have been so altered in character and surroundings that they do not offer the same difficulties in treatment which the recent dunes do in conversion to pasture or arable land.

Owing to the large amount of space which a presentment of the analytical evidence entails this article will be restricted to a description of the types dealt with, leaving to a later date the full consideration of the data which are here collated. No difficulty was experienced in separating the previous types dealt with. A hand-and-eye examination of the most superficial character is sufficient to separate

the dune-sands from the peats, or to say whether they have been mixed. When dealing with the loams it will be necessary to exercise much more caution, for they may merge into the humus soils, the sandy soils, or the clay soils—or would do so if any such be present. In no soil, however, was an amount of clay found which would entitle a sample to be called a clay soil, although perhaps some of the subsoils might merge into clays. Exactly how to classify the soils treated of in this article can be determined only by a careful mechanical separation of the constituent particles into different grades of fineness by means of sieves and settlement in a column of water, and by determining the relative amounts of the differently sized particles present. In this way it has been possible to classify the loams in the following classes and groups:—

Silt Loams, Group 1.—This contains the heaviest type of soil met with in the district, the samples being all similar in the proportion of the different kinds of sediments present. The silts vary from 48 to 52 per cent., the sands from 25 to 27 per cent., and the clay from 10 to 16 per cent. Coarse sand is never present in amounts higher than 4 per cent. Much of the land bordering the Manawatu River is this class of country, and the material may have been largely derived from the eastern or Wairarapa side of the Tararua Range. Chemically, all the soils of the type examined in the vicinity of this river were, with the exception of a forest soil, found to be deficient in available and total phosphoric acid, but the potash was present in quantity. The hillside soils of Waikanae suffer from the same defect—want of phosphates. The Paekakariki soils of this type are, however, well provided with phosphate and carbonate of lime.

Silt Loams, Group 2.—The soils of this group are closely related to those of Group 1, but contain less of the silt fraction and more coarse sand and clay. Generally speaking, they are richer in available plant-food.

Sandy Loams.—As the title denotes, these soils contain a higher proportion of sand, the coarse sand varying from 4 to 33 per cent., the total sands being from 45 to 53 per cent., and the percentage of silts about 25 per cent., while the clay is about 10 per cent. Chemically they are all, except one or two, deficient in available and total phosphoric acid, but are well supplied with total and available potash. Those which owe their sandy nature to an admixture of the Otaki sandstone are invariably deficient in phosphates.

Otaki Sands.—These soils are the easiest type to define of those dealt with in this article. They are derived from the old Otaki sandstone, first described and named by Dr. Cotton, and are distinguished by containing a large amount of coarse sand—from 30 to 40 per cent.—the total fine and coarse sand making the greatest proportion of the soil—roughly 60 to 70 per cent.—and with very small quantities of silt and clay. Chemically they are deficient in both available and total phosphoric acid, but well supplied with potash.

NOTES ON SOILS ANALYSED (SEE TABLES).

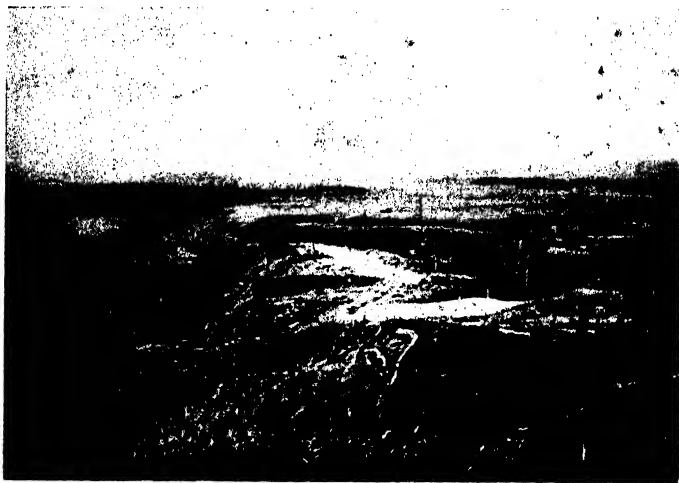
K 265. — Collected (24/8/18) on Arapaepae Road, Kimberley, Block V, Section 14, Waiopahu Survey District (Buller Estate). Greywacke detritus on Otaki sandstone. Down in pasture.



VIEW AT PAEKAKARIKI, LOOKING INLAND FROM DIRECTION OF MODERN FIXED SAND-DUNES.

In background the Tararua Mountains, which contribute the hillside soils, and the fan-lands in middle ground, eroded by sea-action into cliffs. In foreground is a marine plain and ancient swamp from which samples L 419, 420, 422, and 424 were collected.

[Photo, C. A. Colton.



AREA OF OTAKI SANDSTONE (ANCIENT DUNE) COUNTRY AT SHANNON.

This area is much eroded by streams, but capable of supporting forest, as shown by the stumps. Now in surface-sown pasture. Representative of samples K 375, K 492, and L 436.

[Photo, G. L. Adkin.

K 268.—Collected (24/8/18) on Block V, Section 38, Waiopahu S.D., from pasture land adjoining Ohau Bridge, near Rolleston's Creamery, 35 ft. to 40 ft. below the level of the previous terrace, on land originally formed by the Ohau River. This is a flat terrace carrying good pasture, with many stumps of black-pine still remaining, denoting rich soil. Much timothy and white clover present. This is typical of much of the newer river-terrace land of the Manawatu district on which dairying is carried on.

K 269A.—Collected (24/8/18) on Waiopahu Native Reserve, in a gravel flood-plain of the Ohau River. Taken to a depth of 4 in. to 10 in.; a shallow soil on gravel. Totara the dominant forest-tree, with underscrub of *Melicope simplex*, mahoe, hinau, *Myrsine Urviliei*, *Pittosporum tenuifolium*, *Myrsine salicina*, and manuka. Rape and turnips do well on this land where deep enough to plough.

K 270.—Collected (24/8/18) at Ohau Village, Block V, Section 14, Waiopahu S.D. Unploughed land on greywacke detritus on Otaki sandstone. Pasture: cocksfoot and rye-grass now deteriorating or "going out." Similar in character to K 265.

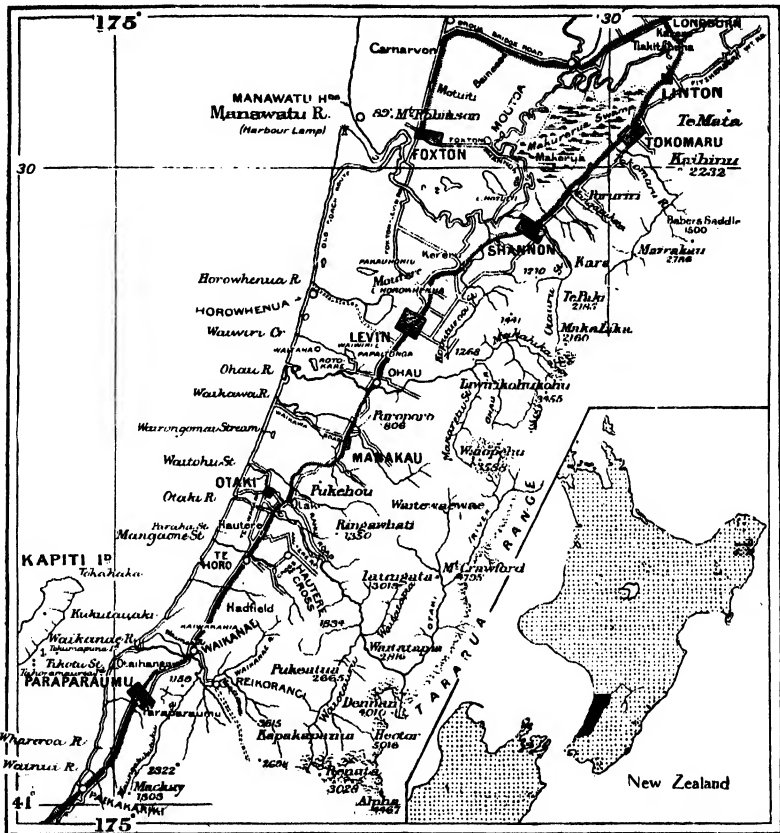
K 272A.—Collected (24/8/18) on Arapaepae Road, between Kimberley and Levin, Block I, Section 4, Waiopahu S.D. Unploughed rough stump country, with a pasture of cocksfoot and rye-grass, now going out and reverting to *Danthonia pilosa* and *Poa pratensis*. Suckling-clover is common, and moss is abundant. This area is typical of a large area of Manawatu country—very flat, and resting on a gravel subsoil. The original forest-trees were tawa and totara, with lesser forest of titoki, mahoe, and rewarewa (*Knightsia*). Soil stony and subsoil gravelly.

K 273.—Collected (24/8/18) on top of terrace, 215 ft. above sea-level, near hills, Block XIV, Section 11, Mount Robinson S.D. This terrace is on Otaki sandstone, but being nearer the Tararua foothills the greywacke detritus is very deep, and it was not found possible to reach the sandstone with the sampler, although the sandstone is well shown in a road-cutting leading to the top of the terrace. Sample taken from Tully's Farm, on the top of the terrace, consisting of some of the finest rye pasture in the district, with a high white-clover content. The pasture has been down fourteen years, and its excellent state is perhaps in part due to its being used for fattening store cattle rather than for dairying, for which latter it is suitable, and which would have resulted in a greater draft on the soil-phosphates. Forest originally tawa chiefly, with occasional pukatea, except in the swampy hollows, where it was more abundant. The underscrub was mahoe, *Hedycarya*, *Pennantia*, and much supplejack, which latter is usually regarded as an indication of good soil. The higher lime-content when compared with surrounding soils will be noticed.

K 277.—Collected (25/8/18) on Block XIII, Section 2, Mount Robinson S.D., Foxton Road, on Otaki sandstone, 300 ft. above sea-level. Land opposite Levin golf-links, undulating, dissected by square-sided gullies, down in pasture many years but never ploughed; no sign of stumps. Pasture consists of crested dogtail, rye-grass, white clover, and Yorkshire fog, with hummocks of *Danthonia pilosa*. Many weeds present, chiefly *Ranunculus parviflorus*, and rushes (*Juncus effusus*) plentiful. Originally forest, as in K 273.

K 280.—Collected (25/8/18) on Block XIII, Mount Robinson S.D., Native reserve. This sample was taken in similar country to last in an area nearer the junction of the Otaki sandstone with the recent blown sand from the coast—a grassed paddock which has been ploughed.

K 372.—Collected (21/9/18) in land near Otaki Railway-bridge, on a gravel flat supporting a light scrubby vegetation. The dominant shrubs



MAP OF DISTRICT DEALT WITH IN THIS SERIES OF ARTICLES.

Scale, 10 miles to the inch. Inset map shows relative locality.

are titoki and *Melicope simplex*, but also present are *Podocarpus totara*, which may have been more plentiful in the past (being removed for fencing), *Myrsine Urviliei*, *Olea Cunninghamii* (maire), *Melicytus ramiflorus*, *Myrtus obcordata*, with occasionally a stunted rimu or matai. The sward of native grass in the interspaces is chiefly composed of *Microlena stipoides* (New Zealand rice-grass). Other plants present were *Muehlenbeckia australis*, *Passiflora tetrandra*, *Astelia Solandri*, *Asplenium flaccidum*, *Earina mucronata*, *Pseudopanax crassifolium*,

Dodonaea, *Cordyline australis*, *Pittosporum eugenoides*, *Coprosma crassifolia*, *Rubus australis*. Block IX, Section 9, Waitohu S.D.

K 373.—Collected (21/9/18) at Pahiku, on Te Waka Road, Block VIII, Waitohu S.D., on Otaki sandstone. This road runs along the edge of a scarp of Otaki sandstone. The soil rests directly on the sandstone as a subsoil. The soil is low in available and total phosphoric acid. This land grows lucerne well, indicating that phosphoric acid is not so necessary for this crop.

K 375.—Collected (21/9/18) at Pahiku, Te Waka Road, Waitohu S.D. Taken on portion of paddock where Otaki sandstone comes to the surface and forms the soil itself.

K 380.—Collected (21/9/18) on Block V, Kaitawa S.D., from fan-land, Waikanae; compound of recent shingle and detritus. Fans similar in slope to that on which Duncan's stud farm rests (situated about one mile north of the railway-station). Very stony land. Soil taken in many places from 2 in. to 7 in. deep. Now down in good English grasses, spotted medick, &c. Formerly covered with "coastal" forest, kohekohe (*Dysoxylum*) being the dominant tree.

K 387.—Collected (23/9/18) in the Esplanade Gardens, Palmerston North, in virgin forest of tawa, pukatea, and white-pine, with small forest and underscrub of titoki, kawakawa (*Piper*), lacebark (*Hoheria lanceolata*), *Shefflera*, mahoe, *Coprosma grandifolia*, *C. robusta*, wineberry, *Geniostoma*, *Aristolelia racemosa*, *Hedycarya*, ferns, and epiphytes, the characteristic habitat of *Adiantum formosum*, which is abundant here. This terrace land on the banks of the Manawatu River must be accounted a rich soil, and is typical of much of the terrace land near Palmerston North.

K 389.—Collected (23/9/18) on high terrace land about 100 ft. above level of Palmerston North, south bank of Manawatu River, Main South Road, three miles from Palmerston. This is heavy land which previously supported tall forest, as shown by the stumps, which now persist on the surface-sown pasture. Pasture poor, becoming invaded by rushes and moss.

K 391.—For full particulars see previous article in last month's *Journal*, p. 63.

K 395.—Collected (23/9/18) in pasture above Otaki sandstone, four miles from Palmerston North, near Tokomaru.

K 401.—Collected (23/9/18) in pasture near Koputaroa.

K 403.—Collected (23/9/18) in forest near Manakau, consisting of tawa, pukatea, and some rimu, with underscrub of mahoe, hinau, kohekohe, *Shefflera*, *Hedycarya*, *Geniostoma*, fuchsia, *Solanum aviculare*, ferns, lianes, and epiphytes.

K 488, &c.—These are ten samples of soil taken (3/1/19) from the different paddocks of the Central Development Farm, Weraroa, for the purpose of making an intensive study of the farm soils. The averages are here given as sufficient for the purposes of this article. The soils varied little in composition, and the paddocks have all been cultivated and manured, and have been used chiefly for dairy-farming for a number of years. The original vegetation was tawa forest.

K 491.—Collected (30/12/18) on Heights Road, at 650 ft., in poor pasture which has reverted to danthonia. Greywacke hillside soil.

K 492.—Collected (30/12/18) on Heights Road, at 350 ft., in Otaki sandstone. The similarity of this soil to that taken near sea-level on the same sandstone (see K 375) is remarkable.

L 419.—Collected (19/9/19) on greywacke hillside with gentle slope, at Paekakariki (Lynch's). Subsoil, greywacke gravel. Pasture contains many rushes.

L 420.—Collected (20/9/19) in paddock on west side of railway-line, north of Paekakariki Railway-station, on flat growing excellent ryeclover pasture—on site of old swamp containing a few stumps. Pasture a close sward.

L 422.—Collected (20/9/19) on flat near Paekakariki, on pasture. Soil probably derived from both dune-sand and hillside detritus.

L 424.—Collected (20/9/19) in long flat paddock of arable land on McKay's Farm, Paekakariki. Down in Western Wolths ryegrass; previous to this turnips, which had been fed off.

L 426.—Collected (20/9/19) on flat area of mixed dune-sand and hillside detritus on McKay's land, Paekakariki. From the stumps extracted, was probably in the past a swampy forest; now highly farmed land.

L 431.—Collected (20/9/19) in dense forest (Hadfield's) at Pararaumu. Forest of kohekohe, pukatea, and tawa, with underscrub of nikau-palm, kiekie (*Freycinetia*), kawakawa, climbing-ratas, *Muehlenbeckia australis*, mahoe, supplejacks, *Parsonsia*, *Geniostoma*, rewawea, "lawyer," ngaio, and titoki.

L 435.—Collected (20/9/19) on hillside, Waikanae Forest: kohekohe, tawa, with underscrub similar to that of L 431, but subsoil stony.

L 436.—Collected (20/9/19) in kohekohe-pukatea forest, on Otaki sandstone, Waikanae.

L 438.—Collected (20/9/19) in hillside mahoe forest, Waikanae, in very stony soil with bare floor. Other trees, &c.: kohekohe, tawa, titoki, rimu, nikau, *Hedycarya*, pukatea, kiekie, tree-ferns, and mixed shrubs. Gravel subsoil.

L 443.—Collected (21/9/19) on terrace above Otaki Township, near Waitahou Valley Road, in tawa-pukatea forest, with usual underscrub.

L 445.—Collected (22/9/19) in manuka-clad terrace near the Ravenswood Cheese-factory. Vegetation consists of manuka (*Leptospermum scoparium*), with much moss and a little poor pasture in interspaces. Only other scrubs, *Coprosma robusta*, *C. propinqua*, *C. areolata*, and *Olearia virgata*, which all occur sparingly in the manuka scrub.

L 499.—Collected (5/10/19) in hillside forest, Waikanae, in kohekohe-pukatea-tawa forest, with usual underscrub, at elevation of 250 ft. Tatton Fraser's property.

L 501.—Collected (5/10/19) in upland pasture (largely danthonia), Waikanae. In similar position to L 499, Tatton Fraser's Farm. This area is very similar to a large area of fan-land, including the well-known Gear Estate. Originally covered with coastal forest.

L 503.—Collected (5/10/19) on same hillside, lower down. This pasture—English grasses and clovers—has been down thirty-five years, and is at present in excellent condition.

MANAWATU DISTRICT SOILS (LOAMS AND OTAKI SANDS).—CHEMICAL ANALYSES.

Results except * are percentages on soil dried at 100° C.

Laboratory No.	Volatile Matter.			Total Nitro- gen.	1-per-Cent. Citric-acid Extract, Dyer's Method; Hall's Modifica- tion ("Available" Plant-food).				Hydrochloric-acid Extract ("Total" Plant-food).				Lime-require- ment (Per- centage CaCO ₃).		
	* On Air- drying.	* At 100° C.	On Ignition.		Lime, CaO.	Magnesia, MgO.	Potash, K ₂ O.	Phosphoric Acid, P ₂ O ₅ .	Lime, CaO.	Magnesia, MgO.	Potash, K ₂ O.	Phosphoric Acid, P ₂ O ₅ .	On Air- dried Soil.	On Soil dried at 100° C.	
Silt Loams, Group 1.															
K 387	Palmerston North: Forest ..					7.91	0.302	0.198	0.060	0.017	0.033	0.88	0.95	0.13	0.14
K 389	Ravensthorpe: Surface-sown pasture ..					8.74	0.292	0.086	0.032	0.031	0.009	0.54	0.25	0.17	0.18
K 391	Ravensthorpe: White-pine forest ..					2.58	0.300	0.096	0.039	0.034	0.009	0.58	0.26	0.22	0.23
K 393	Tokomaru: Pasture ..					9.12	0.252	0.109	0.035	0.026	0.004	0.65	0.30	0.16	0.17
K 401	Koputarua: Pasture ..					2.98	0.240	0.142	0.047	0.035	0.004	0.60	0.36	0.14	0.15
L 420	Peekakariki: Pasture ..					7.54	0.570	0.259	0.053	0.037	0.027	0.82	0.90	0.45	0.47
L 424	Peekakariki: Western Walthys rye pasture (con- tains CaCO ₃) ..					5.24	0.322	0.230	0.051	0.062	0.075	0.80	0.66	0.18	0.19
L 445	Ravensthorpe: Mankia land ..					7.80	0.245	0.063	0.048	0.021	0.005	0.53	0.22	0.25	0.27
L 501	Waikanae: Hillside pasture ..					7.40	0.276	0.153	0.070	0.036	0.008	0.57	0.52	0.14	0.15
L 503	Waikanae: Hillside pasture ..					3.58	0.273	0.173	0.072	0.035	0.011	0.75	0.62	0.10	0.10
Subsoils.															
K 388	Subsoil of K 387 ..					3.70	0.103	0.126	0.042	0.034	0.028	0.76	0.82	0.11	0.11
K 390	Subsoil of K 389 ..					2.32	0.131	0.060	0.040	0.029	0.002	0.51	0.33	0.14	0.15
K 392	Subsoil of K 395 ..					5.05	0.093	0.063	0.039	0.031	0.001	0.29	0.44	0.11	0.11
K 406	Subsoil of K 401 ..					4.89	0.112	0.080	0.033	0.027	0.002	0.61	0.47	0.19	0.20
K 421	Subsoil of L 420 ..					6.03	0.145	0.063	0.039	0.031	0.001	0.29	0.44	0.21	0.22
L 425	Subsoil of L 424 ..					8.49	0.207	0.190	0.058	0.032	0.001	0.79	1.13	0.33	0.34
L 446	Subsoil of L 444 ..					3.86	0.288	0.192	0.041	0.042	0.016	0.60	0.80	0.16	0.16
L 446	Subsoil of L 445 ..					2.82	0.147	0.050	0.040	0.035	0.002	0.49	0.46	0.16	0.16
L 502	Subsoil of L 501 ..					5.14	0.135	0.064	0.070	0.028	0.002	0.38	0.65	0.15	0.15
L 504	Subsoil of L 503 ..					2.72	0.144	0.097	0.072	0.028	0.002	0.53	0.81	0.13	0.13
Silt Loams, Group 2.															
K 265	Kimberley: Pasture ..					13.15	0.353	0.156	0.043	0.029	0.012	0.70	0.60	0.22	0.24
K 269A	Ohau River: Small forest and scrub ..					4.62	0.348	0.198	0.059	0.040	0.006	0.51	0.66	0.21	0.22
K 272A	Kimberley: Surface-sown pasture ..					18.12	0.113	0.086	0.024	0.020	0.007	0.43	0.58	0.34	0.43
K 273	Levin: Pasture ..					12.46	0.318	0.247	0.089	0.059	0.009	1.00	0.57	0.12	0.14
K 380	Waikanae: Pasture ..					11.01	0.318	0.247	0.089	0.059	0.009	1.00	0.57	0.12	0.14
K 403	Manakau: Forest ..					7.72	0.192	0.148	0.088	0.056	0.034	0.76	0.63	0.31	0.34
K 431	Paraparaumu: Dense coastal forest ..					15.78	0.381	0.266	0.085	0.037	0.027	0.84	0.68	0.18	0.19
L 438	Waikanae: Dense coastal forest ..					9.34	0.308	0.096	0.071	0.024	0.011	0.47	0.33	0.27	0.28
L 499	Waikanae: Hillside forest ..					22.60	0.641	0.470	0.171	0.091	0.029	0.64	0.60	0.27	0.28
K 488	Weraroa Central Development Farm: Pasture and arable (average of 10 paddocks)					8.29	0.253	0.131	0.027	0.036	0.005	0.58	0.64	0.17	0.18
						11.74	0.274	0.197	0.055	0.041	0.013	0.74	0.64	0.19	0.20

K 266	Subsoil of K 265	..	..	7.88	8.88	0.249	0.078	0.027	0.025	0.009	0.53	0.59	0.29	0.06	0.23	0.25
K 267	Subsoil of K 265	..	..	3.60	6.37	0.183	0.040	0.014	0.023	0.007	0.56	0.73	0.37	0.06	0.19	0.20
K 274	Subsoil of K 273	..	..	3.26	5.35	0.102	0.080	0.035	0.027	0.001	0.54	0.87	0.33	0.06	0.12	0.12
K 494	Subsoil of K 493	..	..	16.64	9.22	0.272	0.083	0.039	0.025	0.008	0.58	0.86	0.47	0.10	0.17	0.19
L 432	Subsoil of L 431	..	..	2.64	4.35	0.072	0.072	0.042	0.018	0.002	0.37	0.41	0.48	0.05	0.24	0.16
L 499	Subsoil of L 498	..	..	5.82	7.15	0.130	0.045	0.041	0.020	0.002	0.40	0.73	0.49	0.05	0.24	0.25
K 488	Subsoils of same Lab. No. (average of 3 paddocks)	14.4	..	5.82	7.24	0.132	0.073	0.043	0.012	0.005	0.59	0.74	0.36	0.10	0.19	0.20
<i>Sandy Loams.</i>																
K 270	Ohau: Surface-sown pasture	..	..	10.96	10.60	0.206	0.099	0.038	0.033	0.006	0.81	0.39	0.23	0.07	0.19	0.21
K 277	Foxton Road: Surface-sown pasture	..	..	6.10	12.01	0.321	0.260	0.073	0.032	0.008	0.92	0.51	0.26	0.11	0.12	0.12
K 372	Ohaki Bridge: Small forest and scrub	22.7	..	9.12	15.50	0.316	0.221	0.063	0.045	0.005	0.57	0.39	0.41	0.05	0.14	0.15
K 373	Te Whaka Road: Pasture	29.7	..	3.48	7.75	0.245	0.158	0.042	0.030	0.004	0.40	0.38	0.32	0.03	0.13	0.13
K 491	Heights Road: Dantionia pasture	..	..	10.41	8.62	0.234	0.100	0.043	0.024	0.004	0.29	0.40	0.32	0.03	0.15	0.16
L 419	Paekakariki: Hillside pasture	..	..	2.90	8.87	0.295	0.137	0.043	0.030	0.006	0.53	0.47	0.36	0.06	0.18	0.19
L 422	Paekakariki: Flat pasture	..	..	5.04	21.15	0.662	0.250	0.036	0.022	0.017	1.12	0.37	0.32	0.08	0.54	0.57
L 426	Paekakariki: Flat arable (contains CaCO ₃)	..	..	8.84	19.26	0.580	0.385	0.038	0.019	0.052	1.25	0.36	0.38	0.18	0.25	0.27
L 443	Ohaki: Forest	..	..	2.76	7.32	0.242	0.186	0.073	0.033	0.019	0.43	0.40	0.54	0.16	0.13	0.13
<i>Subsoils.</i>																
K 271	Subsoil of K 270	..	..	8.40	6.55	0.147	0.035	0.015	0.020	0.006	0.52	0.50	0.24	0.02	0.18	0.20
K 272	Subsoil of K 270	..	..	3.54	5.16	0.110	0.022	0.010	0.010	0.005	0.53	0.57	0.27	0.04	0.23	0.24
K 278	Subsoil of K 277	..	..	6.96	6.53	0.190	0.109	0.040	0.036	0.004	0.37	0.41	0.14	0.06	0.11	0.12
K 374	Subsoil of K 373	..	..	2.42	4.81	0.150	0.032	0.042	0.022	0.002	0.44	0.54	0.35	0.03	0.17	0.17
L 423	Subsoil of L 422	..	..	3.76	5.57	0.146	0.126	0.032	0.012	0.015	1.25	0.42	0.30	0.07	0.10	0.10
L 427	Subsoil of L 426	..	..	3.62	10.46	0.282	0.068	0.040	0.016	0.009	0.89	0.51	0.47	0.10	0.23	0.24
L 444	Subsoil of L 443	..	..	3.00	8.45	0.228	0.146	0.053	0.028	0.010	0.38	0.92	0.61	0.11	0.09	0.09
<i>Sandy Soil.</i>																
K 269	Ohau Bridge: Surface-sown pasture	..	..	2.92	8.86	0.292	0.203	0.041	0.030	0.025	0.61	0.69	0.64	0.10	0.14	0.14
K 268	Subsoil of K 268	..	..	4.26	5.96	0.183	0.156	0.034	0.020	0.010	0.48	0.75	0.82	0.02	0.08	0.08
<i>Sandy Soils (Ohaki Sands/one Sands).</i>																
K 280	Foxton Road: Pasture	..	..	4.91	8.89	0.257	0.142	0.031	0.054	0.006	0.57	0.44	0.25	0.07	0.16	0.17
K 375	Pahiku, Te Whaka Road: Pasture	..	..	1.92	5.85	0.228	0.162	0.054	0.078	0.007	0.49	0.23	0.20	0.03	0.07	0.07
K 492	Arapaepae, Heights Road: Pasture	..	..	4.72	6.59	0.174	0.138	0.047	0.023	0.005	0.50	0.27	0.20	0.01	0.08	0.08
L 436	Waikanae: Forest	..	..	5.04	8.03	0.283	0.192	0.085	0.049	0.009	0.80	0.40	0.27	0.08	0.04	0.04
<i>Subsoils.</i>																
K 281	Subsoil of K 280	..	..	5.34	5.56	0.124	0.048	0.018	0.027	0.003	0.44	0.40	0.20	0.04	0.21	0.22
K 282	Subsoil of K 280	..	..	2.94	4.37	0.084	0.036	0.015	0.020	0.003	0.46	0.40	0.22	0.04	0.16	0.19
K 376	Subsoil of K 375	..	..	8.8	3.16	0.091	0.086	0.038	0.031	0.005	0.39	0.21	0.21	0.02	0.07	0.07
L 437	Subsoil of L 436	..	..	3.94	6.20	0.192	0.032	0.050	0.037	0.004	0.34	0.40	0.17	0.05	0.09	0.09

MANAWATU DISTRICT SOILS (LOAMS AND OTAKI SANDS).—MECHANICAL ANALYSES.

Results are percentages on air-dried soil.

Lab. No.	Description of Soil. (Classification of U.S. Department of Agriculture, modified.)	Analysis of "Fine Earth" passing 2 mm. Sieve.						Stones and Gravel.
		Fine Gravel.	Coarse and Fine Sand.	Silt.	Fine Silt.	Clay.	Moisture and Loss on Ignition.	
K 387	Silt loam	Nil	25.5	32.7	15.5	11.7	16.0	..
K 389	Silt loam	"	27.9	40.7	11.4	12.5	10.4	..
K 391	Silt loam	"	26.1	37.7	14.7	10.3	12.3	2.1
K 395	Silt loam	"	36.0	30.4	11.2	11.8	10.6	10.7
K 401	Silt loam	"	30.9	32.7	10.0	10.6	16.4	4.3
L 420	Silt loam	"	15.2	30.8	16.3	16.0	21.5	..
L 424	Silt loam	"	21.1	37.3	6.3	19.5	16.0	..
L 445	Silt loam	"	29.4	34.8	11.4	10.7	14.6	..
L 501	Silt loam	"	27.2	35.2	12.2	12.7	11.6	..
L 503	Silt loam	"	27.1	26.9	11.9	12.2	11.2	..
K 388	Subsoil of K 387: Sandy loam	"	45.8	26.7	11.6	10.1	5.9	..
K 390	Subsoil of K 389: Silt loam	"	31.4	34.8	11.0	15.0	8.5	..
K 396	Subsoil of K 395: Silt loam	"	34.7	31.5	12.1	15.8	7.4	20.0
K 402	Subsoil of K 401: Silt loam	"	29.2	33.6	11.6	15.8	10.8	11.1
L 421	Subsoil of L 420: Silt loam	"	17.8	32.6	14.4	23.3	12.0	..
L 425	Subsoil of L 424: Silt loam	"	18.9	26.3	12.9	28.0	14.9	..
L 446	Subsoil of L 445: Silt loam	"	34.6	31.7	11.9	15.4	7.8	..
L 502	Subsoil of L 501: Silt loam	"	27.2	35.2	12.2	12.7	11.6	..
L 504	Subsoil of L 503: Silt loam	"	27.1	36.9	11.0	12.2	11.2	..
K 265	Silt loam	"	27.6	24.5	10.8	5.5	19.2	..
K 269	Silt loam	"	30.6	23.5	10.9	17.7	17.2	..
K 272	Silt loam	1.2	20.2	25.6	3.7	11.0	31.7	..
K 273	Silt loam	Nil	26.1	31.7	10.0	12.2	22.1	..
K 380	Silt loam	"	23.9	24.5	12.2	12.8	25.9	26.4
K 403	Silt loam	"	24.4	28.3	8.9	9.0	30.1	6.0
L 431	Silt loam	"	30.0	31.4	12.0	14.4	12.7	..
L 438	Silt loam	"	29.0	21.8	9.8	11.8	29.8	8.3
L 499	Silt loam	"	31.1	33.2	12.0	13.4	11.7	8.1
K 488	Average of 10 paddocks	"	34.2	24.5	12.8	10.1	16.5	..
K 266	Subsoil of K 265: Sandy loam	Nil	42.0	22.5	9.9	8.9	16.1	..
K 267	Subsoil of K 265: Sandy loam	"	52.1	19.3	9.7	7.6	9.7	..
K 274	Subsoil of K 273: Silt loam	"	30.4	29.1	15.2	18.7	8.4	..
K 404	Subsoil of K 403: Silt loam	"	21.2	31.2	13.3	15.6	18.9	7.5
L 432	Subsoil of L 431: Silt loam	"	37.4	29.7	11.3	15.6	6.6	4.0
L 500	Subsoil of L 499: Silt loam	"	37.3	28.8	12.2	18.9	7.7	..
K 488	Average of 3 paddocks (subsoil)	"	31.7	31.0	11.0	19.8	10.9	..
K 270	Sandy loam	Nil	45.9	16.0	8.7	9.3	20.4	..
K 277	Sandy loam	"	48.6	18.8	6.0	6.3	17.4	..
K 372	Sandy loam	"	50.7	20.3	9.4	9.7	11.0	..
K 491	Sandy loam	"	45.6	16.8	10.8	8.5	16.4	..
L 419	Sandy loam	"	47.4	24.6	10.0	9.0	11.5	3.2
L 422	Sandy loam	"	41.4	12.6	11.8	9.1	25.1	..
L 426	Sandy loam	"	51.5	9.2	6.9	8.4	26.4	..
L 443	Sandy loam	"	47.4	24.0	7.4	11.7	9.9	..
L 271	Subsoil of K 270: Sandy loam	"	51.1	15.3	8.0	11.2	14.4	..
L 272	Subsoil of K 270: Sandy loam	"	60.9	14.6	7.9	6.8	8.5	..
K 278	Subsoil of K 277: Sandy loam	Nil	52.3	15.5	9.7	9.1	13.0	..
K 374	Subsoil of K 373: Sandy loam	"	52.7	15.5	10.2	14.9	7.1	..
L 423	Subsoil of L 422: Sandy soil	"	71.9	8.6	5.3	6.3	9.1	..
L 427	Subsoil of L 426: Sandy soil	"	64.5	6.2	4.3	12.4	13.7	..
L 444	Subsoil of L 443: Silt loam	"	44.6	27.0	10.1	10.0	11.2	..
K 268	Sandy soil	4.7	60.7	12.2	8.5	2.9	8.6	..
K 269	Subsoil of K 268	"	39.3	28.5	9.5	10.5	9.3	..
K 280	Sandy soil	Nil	60.2	11.7	9.3	6.2	13.4	..
K 375	Sandy soil	"	71.0	9.7	8.0	4.5	7.7	..
K 492	Sandy soil	"	60.6	13.1	10.2	5.4	9.8	..
L 436	Sandy soil	"	58.5	15.5	6.7	7.0	12.7	..
L 281	Subsoil of K 280: Sandy soil	"	64.4	9.6	7.0	8.6	10.7	..
L 282	Subsoil of K 280: Sandy soil	"	71.8	5.9	9.0	7.4	7.2	..
L 376	Subsoil of K 375: Sandy soil	"	75.2	8.8	4.2	6.4	5.0	..
L 437	Subsoil of L 436: Sandy loam	"	57.1	14.9	8.9	9.9	9.9	..

NOTE.—Illustrations in this article by courtesy of New Zealand Institute.

(To be continued.)

Pinus insignis for *Hive-making*.—Last season at the Ruakura Apiary *insignis*-pine timber was tried as a substitute for native white-pine in the making of hives, frames, &c. The results have been quite satisfactory.

WEEDS AND THEIR IDENTIFICATION.

(Continued.)

HEMLOCK (*CONIUM MACULATUM* L.).

ESMOND H. ATKINSON, Biological Laboratory.

SPECIMENS of hemlock have been received for identification from several widely separated localities during the past year, with the information that it was suspected of poisoning stock. An account of the plant will, therefore, not be out of place in this series of articles.

DESCRIPTION.

Hemlock is a tall biennial herb reaching a height of from 2 ft. to 5 ft. in the flowering season, with a stout tap-root rather like that of a dock or a parsnip, which penetrates deeply into the soil.

The stem, which is hollow throughout its length except at the nodes or joints, and much branched above, is as thick as the thumb, or thicker at its base, rather obscurely marked with longitudinal grooves, and in its ground-colour bluish-green, owing to the presence of a delicate bloom like that on a plum. The most conspicuous feature of the stem, however, is the presence of numerous purplish-red spots, which are scattered irregularly over its surface, usually becoming more abundant towards its base.

The stalks of the lower leaves are a foot or so in length, hollow, and about as thick as the stems, which are clasped by their broad expanded bases. These leaf-stalks are spotted like the stems, so thickly, indeed, that the whole basal part of the stalk is often stained a uniform purplish-red, giving it an appearance not unlike rhubarb. The lower leaves are several feet long, including the stalk, and are roughly triangular in outline. The leaf is what is known as compound—namely, one composed of a number of secondary leaves, which in this case are borne in opposite pairs on either side of the main axis of the leaf, and are themselves several times again divided in a similar way. The ultimate divisions are sharply pointed, and from their extreme number and fern-like delicacy make the whole leaf a very graceful one. The leaves borne on the upper part of the stem are very similar to the lower ones, but are much smaller and less divided, and have shorter stalks.

The flowers of hemlock are arranged in what are called umbels, an umbel consisting of a main flower-stalk, from the apex of which arise, all from the same point, a number of secondary stalks or rays spreading so as to form a flat-topped or rounded head. Each of these rays bears either a single flower, when the umbel is said to be a simple one, or another much smaller umbel, the whole inflorescence being then called a compound umbel. The umbels of hemlock belong to the second of these two classes, and are from 1 in. to 3 in. in diameter. At the point of insertion of the primary rays are several bracts,

variable in number, while at the base of each secondary umbel are three others turned outwards, this arrangement of the bracts being peculiarly characteristic of hemlock. The flowers themselves are small, with five white petals. They need not be further described, as they are very similar to those of a number of allied species and are of little importance in the identification of the plant.

The flowers are pollinated by insects, and each flower develops into two fruits, which have appearance of seeds and are popularly known as such, though in reality each is a one-seeded fruit, the enclosed seed filling most of the interior and being comparable to the kernel of a peach-stone. Each fruit is about $\frac{1}{4}$ in. long by $\frac{1}{10}$ in. broad, and more or less flat on one face and strongly convex on the other, the convex face bearing five slightly waved longitudinal ridges. The fruits are arranged in pairs with their flat surfaces together, and when fully ripe are suspended by their upper ends from the top of a slender stalk which lies between them and is the elongated axis of the flower. At this stage they are of a warm grey colour with a faint tinge of fawn.

Hemlock seeds freely, and seedlings may generally be found in all stages of development where the weed is at all plentiful. The seed-leaves are rather long and narrow, and are faintly veined above; they are soon followed by the first finely cut foliage leaves. The spotting so characteristic of mature plants is not apparent for some time, but as a rule quite small seedlings have their leaf-stalks and stems more or less deeply stained with purplish-red or pink.

All parts of hemlock have a peculiarly strong and disagreeable smell, which in the case of the dried plant is decidedly mouse-like, while in the living plant it is faintly suggestive of fennel and several allied species, though not quite like any of them.

PLANTS SIMILAR TO HEMLOCK.

Hemlock belongs to the large and very distinct family *Umbelliferae*, which, besides including several very poisonous plants, contains a number useful to man in various ways. The chief edible species are the carrot, parsnip, celery, and parsley, while others such as fennel, caraway, &c., are used for flavouring and other purposes.

The genus *Conium* comprises only two species (or a single one according to some authors), but several of the allied genera include plants superficially not unlike hemlock, and in view of the poisonous nature of the latter it is important that the differences between them should be known.

The leaves have been mistaken for those of parsley, with fatal results; but their greater size, more sharply pointed ultimate segments, peculiar smell, and spotted or stained stalks should be sufficient to enable any one but the most unobservant to distinguish between the two plants. Cases of poisoning have also occurred through the roots being eaten in mistake for parsnips; but the large and broad segments of the leaves of parsnip are entirely different from the feathery leaves of hemlock.

The fruits or "seeds" of aniseed (*Pimpinella Anisum*) are very like those of hemlock, and commercial lines of aniseed have from time to time been observed to be contaminated with them. The larger

HEMLOCK (*CONIUM MACULATUM* L.).

(A) Base of stem; (B) Root; (C) Fruiting-umbels; (D) Young plant; (E) Fruits.

A to D about natural size; E magnified about 3 diameters.

[Drawing by E. H. Atkinson]

size of hemlock fruits and the absence of the smell characteristic of aniseed are the chief points of difference. The plant most like hemlock in general appearance is fool's-parsley (*Aethusa Cynapium* L.), and it has the same mouse-like smell. As far as the writer is aware, however, this plant has not yet been recorded from New Zealand, but even if it should become naturalized here the fact that it further agrees with hemlock in possessing poisonous properties makes it unnecessary for the farmer to be able to distinguish between the two plants, both being undesirable.

THE POISONOUS PROPERTIES OF HEMLOCK.

It has been known from time immemorial that hemlock is an extremely poisonous plant, and it was employed by the ancients to poison criminals condemned to death, the case of Socrates being the classic instance of its use in this way. The "seeds" are the most dangerous part of the plant, which, however, is everywhere more or less poisonous, though drying decreases its virulence.

The effect of hemlock on man and animals is due to the presence of several alkaloids, the chief of which is coniin. This substance, which has the chemical formula $C_8H_{17}N$, is somewhat volatile at ordinary temperatures, has an alkaline reaction and a burning taste, and causes dilation of the pupil. The percentage of coniin in fresh leaves is 0.095 and in the ripe fruit 0.7.

The following account of the symptoms of hemlock poisoning is taken from Pammel ("Manual of Poisonous Plants," p. 651): "The symptoms in man are due to a general and gradual weakening of muscular power. The power of sight is often lost, but the mind usually remains clear until death ensues, as it soon does from the gradual paralysis of the lungs. . . . Many domestic animals have been killed by eating the plant, the prominent symptoms described for cows being the loss of appetite, salivation, bloating, much bodily pain, loss of muscular power, and rapid, feeble pulse. . . . It paralyses the ends of the motor nerves, then the trunks, and lastly the motor centre itself. Respiration is quickened and pupils contracted. The fatal dose, according to Blyth, is 2.3 grains."

HEMLOCK AS A WEED.

Hemlock has been naturalized for very many years in New Zealand, probably having originally spread from gardens, where it is occasionally grown. It is now abundant in a great many localities in both Islands, and it is not particular as to the class of soil it affects, though as a rule it occurs most abundantly in such places as stockyards and along roadsides, being particularly luxuriant where some shelter is afforded by hedges, &c., though this is not essential to it.

Hemlock is on the Third Schedule of the Noxious Weeds Act, and is "declared" by many local authorities. In the case of most plants that are regarded as weeds it is the fact of their occupying areas to the detriment or total exclusion of more useful plants that makes them objectionable. Looked at from this point of view alone hemlock, in comparison with many other plants, would sink to a position of insignificance in New Zealand, but owing to its poisonous properties, even if it is occupying ground that would not in any case

be carrying a useful crop, its presence in places accessible to stock is a menace to the farmer. Fortunately, however, the strong smell of the plant, which is so unpleasant to man, is equally so to most kinds of domestic animals, and the majority of cases of poisoning occur either with driven stock feeding on roadsides, &c., or during abnormal seasons when the supply of feed is small. A point of importance is that stock are far more likely to eat the plant after it has been cut and become partly dried than when it is in a growing and green condition. It is therefore recommended when cutting down any plants to at once remove them from the reach of stock.

As regards the actual control of hemlock very little can be said, except that it is advisable to be on the safe side and to grub out all plants that make their appearance. From what has been here said it will be obvious that it would be unwise to disregard the possibility of hemlock becoming highly dangerous under certain exceptional conditions, even where it has been known to exist for many years without causing any trouble.

HERD-TESTING ASSOCIATIONS.

SOME RESULTS FOR SEASON 1919-20.

W. M. SINGLETON, Assistant Director of the Dairy Division.

WITH the extension of C.O.R. testing and the appointment of additional testing officers for carrying on this work it has been found possible by the Dairy Division to undertake more-association testing of ordinary dairy herds. During the past season some twenty-two dairy companies co-operated with the Division in carrying on this line of work. The season now coming will see a considerable extension of this method to some districts where hitherto little or no herd-testing has been undertaken, provided that testing requisites can be procured. Considerable organization work has already been done, and in a number of districts a start can be made shortly after the arrival of the milk-sample bottles which have been on order for many months.

Dairy companies' directorates co-operating in this work agree that the Dairy Division's testing officer shall have the use of each company's testing-room, testing-appliances, and steam free of cost. The herd-owner supplies his box for milk-samples, sample-bottles, spring balance, and sampling-dipper. Officers of the Dairy Division do the testing and figuring, and the record forms are supplied by the Department. For this service by the Department and officers of the Dairy Division a testing-fee of 2s. per cow per annum is charged. The collection of these fees is undertaken by the dairy companies, as the association members agree that their indebtedness shall be a charge on their milk accounts. It is an essential preliminary that the dairy company should agree to make this collection and pay the aggregate amount through the Dairy Division to the Public Account.

Only a portion of the total herd-testing of the Dominion is done by the Dairy Division. During the past season the spring was unfavourable to liberal production, but nevertheless many exceedingly creditable records have been made. We give below a tabulated list, in which the associations are indicated by numbers. No records of cows milking less than one hundred days have been included in the finding of the yield of the average association cow. The number of days which such average cow was in milk is given to enable a comparison to be made between yield and milking-period. The yield of the average cow in the best and poorest yielding herds of each association is also included. The statistics are as follows:—

Association No.	Number of Cows.	Association Average.		Highest Herd-yield in Association.		Lowest Herd-yield in Association.	
		Days.	Fat.	Days.	Fat.	Days.	Fat.
			lb.		lb.		lb.
1	390	218	210.65	227	317.13	119	66.53
2	29	187	159.77	247	258.28	119	77.61
3	259	198	217.95	242	301.63	118	144.92
4	666	227	248.08	244	366.27	108	106.09
5	834	216	228.43	255	317.63	128	117.94
6	430	237	227.16	297	319.83	124	107.90
7	304	262	289.62	299	403.47	259	234.22
8	178	210	234.52	253	305.81	102	126.81
9	682	213	251.23	244	349.36	100	101.20
10	223	190	189.09	240	298.49	148	98.43
11	499	225	206.97	249	288.69	178	114.63
12	343	254	277.11	264	394.91	212	212.45
13	265	188	195.31	265	347.01	105	85.59
14	158	211	160.06	244	210.47	148	126.98
15	265	187	177.58	221	296.04	150	108.42
16	350	246	259.54	287	396.39	210	160.41
17	437	210	195.53	265	362.76	124	85.84
18	95	239	279.65	272	354.89	199	207.81
19	630	204	220.82	255	304.37	127	98.48
20	240	225	236.60	264	300.02	122	150.35
21	195	214	202.08	251	263.38	113	102.59
22	119	195	198.13	295	383.50	112	120.51

	Days.	Pounds Fat.
Average of all cows (7,591)	223	230.25
Highest association	262	289.62
Lowest association	187	159.77
Highest individual herd	299	403.47
Lowest individual herd	119	66.53
Highest individual cow	286	555.22
Lowest individual cow	101	11.98

The average cow in all these associations has a calculated yield of 230.25 lb. of butterfat, produced in a 223-day lactation period. This is very creditable, but it cannot be taken as a criterion of the production of the average cow of the Dominion. Each of these associations includes a comparatively small proportion of the cows supplying each of the dairy companies represented. As a rule the association members are above the average calibre of dairymen in the district, and thus the yield of the average association cow is undoubtedly in excess of that of the average cow supplying the same factory.

It will be noted that the association (No. 7) with the highest credit for butterfat per cow shows an average milking-period of 262 days, which is a longer period than that of the average cow of any other association represented in this list. The three associations, Nos. 7, 18, and 12, with average cows credited with 275 lb. of butterfat or more, show an average milking-period of 262, 239, and 254 days respectively. The majority of the associations with average cows yielding less than 200 lb. of fat have comparatively short milking-periods. The figures suggest that to obtain the better yields a fair length of milking-period is necessary. In association No. 7, which has the best average yield, it will be seen that the best producing herd of all the associations milked for an average period of 299 days, or ten months. This is accepted as an ideal length of milking-period. In this herd one cow is credited with 555.22 lb. fat in 286 days. This cow was in the best producing herd in its association—a herd which has a yield for the average cow of 396.39 lb. fat in 287 days. The owner is known to have been grading up his herd for some years by using registered purebred bulls, and saving heifers sired by these from the progeny of two good cows used as the principal foundation of the herd, so far as the female side is concerned. These high-producing herds are usually not accidents, but are rather the resultant product of years of planning, breeding, and patient effort.

The lowest average herd-yields of the last two columns, as contrasted with the figures of the highest-yielding herds in the respective associations, give a striking illustration of the necessity for a milking-period sufficiently long to enable a cow to do her best for her owner. It is manifest that cows must be so bred as to enable them to milk during a reasonably long lactation period, and that they receive the necessary feed to enable them to continue to the proper end.

THE LATE HON. W. D. S. MACDONALD.

It is with sincere regret that the *Journal* notices the untimely death, on 1st September, of the Hon. W. D. S. MacDonald, who held the portfolio of Agriculture during the term of the National Government, from 1915 to 1919. In his Ministerial leadership of the Department Mr. MacDonald proved himself a strong man and thoroughly progressive, although his policy was much handicapped by war restrictions. His wide practical experience as a farmer was also brought to bear effectively on many important matters. With his responsible officers he was a popular chief—concerning himself with the broader side of departmental administration rather than with its details—what is termed a good man to work with. His genial, sympathetic nature was well known. An excellent contemporary portrait of Mr. MacDonald was published as a frontispiece in the issue of the *Journal* for September, 1915, shortly after he became Minister of Agriculture. To Mr. MacDonald's family we extend deep sympathy in their loss, which is also the loss of the Dominion.

BREAKING-IN OF LIGHT PUMICE LANDS.

SETTLERS' EXPERIENCE.

W. G. BUTCHER and E. EARLE VAILE, Waiotapu.

LIGHT pumice soils occupy several million acres in the centre of the North Island. It is estimated that they constitute about one-twentieth of the whole cultivable and habitable lands of New Zealand, and the bringing of them to a profitable condition is undoubtedly one of the greatest development propositions before the Dominion to-day. The pumice country, it need hardly be remarked, includes considerable areas of superior river-flats and swamp-land, such, for instance, as large parts of the Reporoa Estate, recently acquired by the Government. But it is not such land as Reporoa that we are here concerned with; the following notes deal only with the light "poor" lands, concerning which there is still much uninformed prejudice. The vast bulk of such lands are ploughable—that is, easily ploughable—with a double-furrow plough. Areas that are not so ploughable are, in our judgment, best adapted for afforestation. It is marvellous country for growing trees, but for ordinary farming the land should be easily ploughable.

CLEARING AND PLOUGHING.

Light pumice country is probably the easiest broken in of any land. Clearing may be done in many places by fire put in about three years ahead of requirements. The horses and bars will break down the half-rotten sticks, and the plough will cut them up and bury them. Denser or heavier growth must be cut, and, as far as our experience goes, the common slash-hook is still the best means. We regard it as a mistake to bury anything but the lightest scrub. With heavier stuff a cushion is formed between the underlying earth and the furrow, which effectively prevents the soil-moisture rising. Consequently, a brief period of dry weather will kill anything sown in the top sod. Again, for about three years afterwards one cannot put the plough in, as all the buried sticks would be merely brought to the top. There are, however, large areas of tussock and light scrub that can be ploughed straight out of the rough.

Any plough will make a fair job in light pumice land, but probably the best for a first cultivation is a "heavy" P. and D. Duncan double-furrow. It will easily handle all ordinary stumps and pumicestones, saving many shillings per acre in clearing as compared with a lighter plough. It has sufficient clearance to avoid blocking with rubbish, and the weight on the skeith is enough to cut through ordinary sticks. The land should be ploughed as deep as possible, but so as not to turn up more than half an inch—or at the most an inch—of the raw sand or pumice. The depth can be slightly increased at each subsequent ploughing. The disking should follow the furrow, and one stroke is usually sufficient. Then harrow so as not to turn up roots, &c., to the

surface. Finally, roll heavily. Drilling should be done with a disk drill so as to avoid the gathering of rubbish in front of the hoes. It is not wise to work light pumice soils too fine.

THE FIRST CROP.

The first crop should be put in right away. This cannot be done too quickly. A bare fallow on really light pumice is the greatest mistake: the soil leaches badly, and sorrel soon takes possession. The crop undoubtedly should be turnips. Any pumice land will grow good turnips—the very lightest, soft turnips; the next better quality, Aberdeens; and the heavier and moister soils, swedes. Purple-top Mammoths, many roots weighing up to 14 lb. each, have been grown on pure pumice sand, on a first furrow, with 2 cwt. manure to the acre. Of course, these turnips need feeding off when they are just right. Aberdeens—we prefer the Green-top variety—do well on soils only slightly heavier, and can be fed right into September. The best time to sow turnips is in the latter half of December. If any one doubts the capacity of pumice lands to grow turnips let him study the regularity with which roots from the Rotorua-Waiotapu country secure prizes at the Waikato, Palmerston North, and other leading winter shows—and this without special attention or cultivation having been given for show purposes.

In sowing turnips we give 1 cwt. each of super and blood-and-bone—2 cwt. in all. It would really pay to give 3 cwt. if one's resources allowed. Usually we have rolled again after the drill, but this may not be necessary or, in some cases, advisable. A light brush harrow towed behind tends to cover all seed on the naturally somewhat rough surface of a first cultivation. A stroke of the chain harrows in front of the drill, if there is time and if the soil is not already too fine, tends greatly to an even surface.

SUBSEQUENT CROPS.

We do not advise grain crops in light pumice land, as they take too much out of it and encourage sorrel. In almost any section in this district an area of heavier land may be found upon which to grow oats. But if one must grow chaff on the light land a heavy crop should not be aimed at. Between $1\frac{1}{2}$ and 2 bushels of seed, with 2 cwt. of the same mixture of manure, should give a good enough cut. Duns in autumn, Sparrowbills in early spring, and Tartars in later spring have given best results. Rust is very rare in the pumice country.

GRASSING.

The main consideration in grassing is getting a soil-covering. Bare spaces are fatal; therefore grasses that will grow should be sown. Cocksfoot gives most feed, except in winter, when frosts cut it rather badly. Perennial rye-grass is not perennial—if one may express it that way. Italian rye is useful for a quick bite while the other grasses come on. Crested dogstail forms a good sward. *Danthonia*—the pilosa variety—forms a dense sole absolutely permanent, and keeps green throughout the winter. It is hard to sow through a distributor. Brown-top gives good pasture in spring and autumn, but yields no feed during frosts or drought. It, more than any other

grass, tends to creep into and fill up all bare spaces, although inclined to get root-bound. Yorkshire fog is a grass too much neglected. It grows anywhere and gives a great bulk of feed, even if it be of rather poor quality. More than any other grass it adds humus to the soil, and it gives place to better grasses without much trouble. Among the clovers cow-grass is supreme, yielding an immense quantity of rich feed on all pumice soils. On its cost it pays far better than any other pasture plant. White clover also thrives astonishingly, and, once established, never leaves the soil. The native trefoil or suckling-clover is very useful, and sheep's burnet is a welcome addition to the bulk of the pasture.

The following is a good mixture for ordinary light pumice land: Cocksfoot, 10 lb.; Italian rye-grass, 4 lb.; crested dogstail, 4 lb.; Yorkshire fog, 2 lb.; brown-top, $\frac{1}{2}$ lb.; Chewings fescue, $\frac{1}{2}$ lb.; cow-grass, 4 lb.; white clover, 1 lb.; suckling-clover, 1 lb.; sheep's burnet, 2 lb.; with 6 oz. soft turnips added for spring sowing, or 1 bushel ryecorn for autumn sowing. If this should be considered too expensive a seeding the cocksfoot might be cut down 2 lb. and the rye-grass and dogstail 1 lb. each.

A mixture such as this, for a first furrow, will become quite permanent, but probably it will pay to plough it after about seven or eight years. A crop of swedes should be put in this time, and the land afterwards relaid with better grasses for a permanent sward.

In our opinion manure is best applied with the seed—as much as can be afforded within reason, but not less than 2 cwt. per acre. Superphosphate mixed with blood-and-bone or bonedust gives best results. Basic slag and Egyptian phosphate do not seem suitable for light pumice land. Spring sowing should take place early in October, and autumn sowing in the latter half of February or the first week in March.

For surface-sowing we recommend *Danthonia pilosa*, 3 lb.; brown-top, 1 lb.; Yorkshire fog, 5 lb.; suckling-clover, 1 lb.; white clover, $\frac{1}{2}$ lb.; sweet vernal, $\frac{1}{2}$ lb.; *Lotus hispidus*, 1 lb.; Chewings fescue, 2 lb.; and crested dogstail, 1 lb.

Some settlers adopt and strongly advocate the practice of sowing grass and turnips together on the first furrow, and this plan certainly yields a quick pasture. On no account should oats for a crop be sown with the grass.

MANAGEMENT OF PASTURE.

There is as much in the treatment of the paddock after being laid down as there is in the laying-down itself. Overstocking should be carefully avoided, especially in the autumn or early winter. If at that time the roots are left exposed to all the frosts of winter, deterioration is bound to ensue—especially of cocksfoot. Do not put stock on to young grass too soon. It is best to stock first with calves. Keep sheep, and even more particularly horses, off for the first year, if possible. After a year or two it is an excellent plan to "fog" a paddock—that is, to shut it up in September or October and rigorously keep stock off it till early March. By this means much seed is cast, and a mass of vegetation goes down on the surface, forming a mulch of humus. This greatly encourages the stronger pasture-plants—cocksfoot and cow-grass especially—and is a cheap method of restoration. If the paddock is then heavily stocked in March the seed is trodden in, and much will germinate.

The writers have not tried top-dressing, but doubtless it would be beneficial. Nor have they had enough heart to plough in green crops. In their opinion it is preferable to feed off these green crops, and the resultant dung, with a little artificial manure added, will probably pay better than ploughing in the crop itself. Again, a surface covering as compact as possible should be created and maintained. Do not plough and leave light pumice soil bare if it can be avoided.

GENERAL.

Pumice soil is very kindly stuff to work. Never sodden, never baked—it may be worked at will every day in the year. It handles soft and velvety, is very warm, and forms a perfect seed-bed. Pumice may fairly be termed natural grass country. Even if one has had a bad strike, under careful management the grass will thicken out. The soil yields wonderfully to judicious cultivation and manuring. Cows are found to milk extremely well on pumice land. It must be borne in mind that large parts of the Waikato district are pumiceous soils.

The pumice country proper, however, is no place for the lazy man. Growth in the winter is meagre, and provision of fodder must be made for the time of scarcity. Here nature comes to the rescue, for there is no land that will grow clover for hay or roots for feeding off in the winter better than the pumice lands. And they are exceptionally suited, too, for the feeding-off process—never any slop or mud, while the soil is much improved by the tramping of the stock.

At the request of the Editor we have noted down as above the results of many years' practical experience in the working of light pumice land. There is, of course, plenty of room for further experiment, and other persons may arrive at somewhat different conclusions. We trust that others will be given the opportunity to follow up the subject in the pages of the *Journal*.

"Tarry" Soils.—In his annual report for 1919-20 the Department's Chemist (Mr. B. C. Aston) mentions that the so-called tarry soils of Oamaru have been investigated, and found to have a lime-requirement of from $\frac{1}{4}$ to $\frac{3}{4}$ ton of carbonate of lime per acre. These soils rest on a limestone subsoil, and are another instance of the popular fallacy which assumes that because a soil is on limestone it contains sufficient lime.

North Canterbury Scrub Lands.—Further samples of these soils recently examined by the Chemistry Section proved, after separation from the gravel, to be fine sandy silts or loams deficient in available and total phosphoric acid, the amounts of nitrogen and other mineral plant-foods being high. The Chemist states that the treatment indicated as most desirable would seem from analysis to be phosphatic and lime-carbonate manuring, and the stimulation of the growth of Leguminosæ with a view to increasing the humus in these light lands. The area in question is situated between the Rivers Eyre and Waimakiriri, some thirty miles to the north of Christchurch.

THE PIGGERY.

K. W. GORRINGE, Instructor in Swine Husbandry.

SITE.

It is not generally recognized by farmers how important it is that great care should be taken in the selection of a site for the piggery. Many mistakes have been made in the past in this respect, resulting in severe losses both to breeders and feeders. Farmers, in fact, have followed the ideas practised by their forefathers, and have too often built their piggeries more for the sake of their own convenience than for the comfort and well-being of the pigs. They have not sufficiently realized what they are doing when they enclose any small plot of ground—say, about half a chain square—and place a shed in one corner in which to keep their pigs from year to year. This may give good results for a start, but as time goes on the shed and the whole plot become infested with parasites and germs, unless special attention is given to the disinfecting of the whole premises, which, one regrets to say, is very generally neglected. One often hears the remark that a place is “pig-sick.” The proper definition of the matter is that the piggery is so infested for want of proper sanitation that the pigs have to fight for their very existence.

In selecting a site it is important to avoid low or wet ground. High ground with good drainage, a gentle slope, or rolling country, is to be preferred. If it is the breeder's special desire to build a permanent or central house, special care should be taken to choose the most suitable site for the house to rest on. Springs under the ground, not seen or felt, yet close to the surface, have been the cause of continual dampness throughout pig-houses, even though the whole of the ground-surface has been covered with brick or concrete.

It is advisable to portion off an area of the farm for the pigs, the minimum to be $1\frac{1}{2}$ acres, divided up into four equal paddocks—the idea being to give the animals a change from one paddock to another. These paddocks can be sown down with any good forage crops and grasses, and the fact that they will occasionally be ploughed up and resown will tend to keep the area in a good, healthy, and sanitary condition.

In connection with a site the water-supply is of the greatest importance. Provision must usually be made to supply this artificially, as it cannot be obtained by having a creek running through the piggery in cases where the water flows through another property afterwards. Good fresh water plays a very important part in the health of all pigs, whereas foul and dirty water is often the cause of worms and other intestinal complaints. It is essential that good clean water be within reach of the pigs at all times; it is astonishing what a large quantity will be consumed, especially during the summer months.

Together with the question of site, the legal provisions embodied in different statutes must always be kept in view. No drainage from a piggery is allowed into a running stream if this afterwards runs through another property, or is afterwards used for any other purpose. All pigs must be kept at least 50 yards away from the nearest milking-shed, dairy, or slaughterhouse, and must not be so placed as to become a nuisance to the general public or adjoining dwellings in occupation.

SHELTER.

Shelter from exposure is a very important point. The prevailing wind should be taken into consideration, and the piggery so placed as to have as much protection as possible from cold biting winds. If this is difficult, provision should be made for rapid-growing shrubs, &c., just outside the fence. Trees or other taller growths should be kept some yards away, as in after-years they will have the tendency to keep the piggery damp if they are planted too close. On many farms a belt or block of natural bush has been kept for general shelter. This could be used to great advantage in connection with the site of the piggery. It will also be found beneficial to have a few shelter-trees planted down the subdivisions, such as willows, wattles, or any variety that has a good top and a small root-system. A large-rooted tree would in time interfere with the ploughing operation in the paddocks.

FENCING AND YARDS.

With regard to the style of fencing, this must be left to the judgment of the breeder. It has been found that a fence containing six pig-barbed wires, one plain wire, and one ordinary barb wire on top to make it cattle-proof, gives good results for the outside boundaries. Six posts to the chain, with four battens in between, will be sufficient. For the subdivision fences seven plain wires, well strained, with six battens between posts (spaced six to the chain) will be found to give satisfaction. If the plain wires can be strained on the roller system, the roller to remain on the strainer-post, in the event of any wire becoming slackened it is very easy to tighten again. Suitable distances apart for the wires on the boundary-fence are one nearly on the ground, then two at 3 in., two at 4 in., one at 6 in., one at 9 in., and one at 14 in. For the subdivisions the distances will be one wire close to the ground, three at 3 in., and three at 4 in. If the breeder can afford to be liberal with extra battens, so much the better for the life of the fence. Provision should be made for gates 9 ft. wide into each paddock, so as to allow any farm implement, also the pig-houses, to pass through.

It will be found very handy to provide a small yard as a drafting-pen, in which can be built the staging for loading and unloading pigs to and from market. There should also be an enclosure some distance apart for the purpose of isolating pigs suspected of disease, or to accommodate any pigs which may be introduced until such time as it is evident that they are free from infectious or contagious disease. This enclosure should be so constructed as to be easily disinfected if it be necessary to do so.

HOUSING.

Pigs are very susceptible to the unfavourable influences of damp, cold, heat, and draughts. The pig-house should thus be warm, so that a minimum amount of feed will be used up in maintaining the body-heat of the animals. It should also be dry; sweating walls or damp floors are highly objectionable. There should be an abundance of sunshine in the cold months, as sunshine is not only one of the greatest germ-killers known, but tends to dryness and warmth, besides having an invigorating effect on the pigs. Plenty of fresh air without draughts is also a feature of importance.

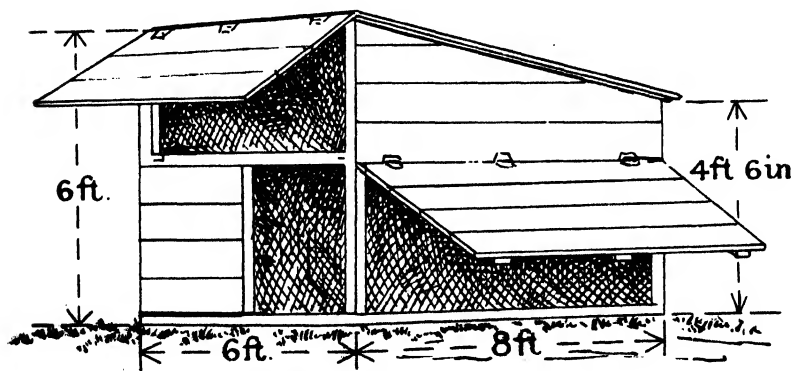
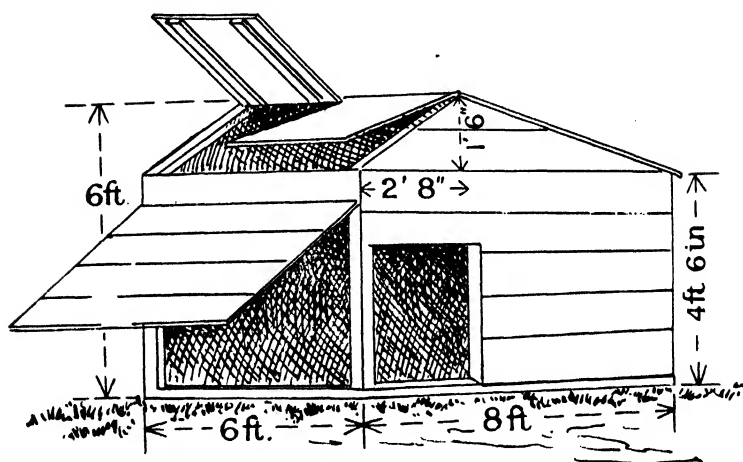
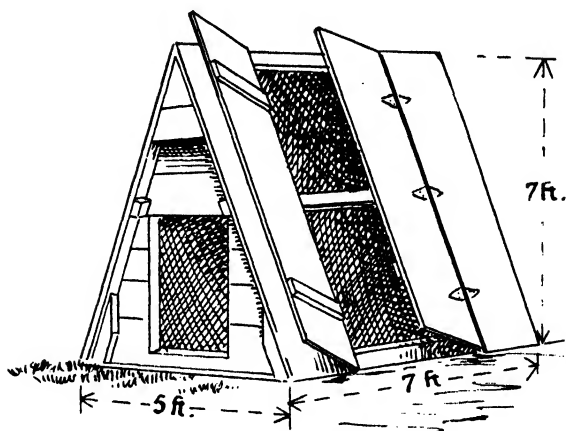
There are two general types of pig-houses—the central type, and the individual or movable house. A central house contains a number of farrowing and fattening pens under the same roof, while an individual house is made so as to keep only a single farrowing-sow, or it can be used for a number of young growing pigs. The chief advantages claimed for central houses are that they are more convenient, necessitate less labour and care for the pigs, and are warmer. On the other hand, it is claimed for individual houses that they are cheap and easy to build, better for farrowing-sows (preventing crowding or piling up), quieter, movable to cleaner ground, and more sanitary.

Owing to the favourable climatic conditions for pig-keeping in New Zealand as compared with many other countries, I am of opinion that the central house has very little advantage here. It is, besides, very expensive to construct and beyond the means of the average breeder. I have found that where a large number of animals are housed under one roof the atmosphere becomes very dead, and young pigs farrowed under such conditions do not thrive nearly so well as those farrowed in individual houses. After comparing the useful points of both types I therefore do not advocate the building of central houses for general use of the average farmer.

If, however, the breeder specially desires a central house great care must be taken, as previously mentioned, in the selection of the site on which it is to rest. Allowance must be made for good drainage, also for the admission of sunlight throughout the whole house. It is generally the breeder with a large herd who adopts this mode of housing, and one of the many designs can be selected and built to requirements. It should be realized, however, that if the breeder is not prepared to keep such a house very clean and to be liberal in the use of disinfectants trouble may be expected. In building a central house a concrete reservoir should be placed at the end of the building to catch all the drainage. No breeder should be guilty of wasting this valuable liquid manure, which can be pumped up and carted over the land at comparatively little expense.

INDIVIDUAL MOVABLE HOUSES.

From my experience and observation generally, and taking into consideration the economy in construction, ease of handling, and greater healthfulness, I consider, without a doubt, that the light movable pig-house provides the best and cheapest housing for general use. There are various designs to choose from—the gable-shaped, the two-thirds span roof, the lean-to, &c., as shown in the accompany-



DIAGRAMS OF MOVABLE PIG-HOUSES.

(Runners not shown.)

ing diagrams, which also give the principal measurements. The diagrams indicate wood boarding, but other materials, such as iron, or rubberized felting, may be used, as convenient. Each house rests on 4 in. by 4 in. runners; these are not shown in the diagrams. Around the inside of the houses, 8 in. from the sides and floor, a guard-rail must be placed for the protection of the young pigs. Ventilation is provided at the ends of the roof, and parts of the sides or roofs are hinged for opening out to let in the sun, as shown. Whereas permanent houses should be built facing the north, so as to get as much sun as possible, portable houses can be moved to suit the convenience of the breeder and the comfort of the pigs.

CLEANING AND DISINFECTING.

Any style of house can become infested with parasites and germs; therefore the houses must be kept clean, no dirt being allowed to accumulate in the corners. It is of little use applying a disinfectant on top of a coating of filth which may conceal and protect millions of disease-germs. A good spray-pump is the best to use, so as to force the liquid into every crack, and every part of the pen should be thoroughly saturated with the solution. Limewash is also good. A liberal sprinkling of slaked lime will be found beneficial around houses, feeding-troughs, and yards.

Proper attention to this important question of housing will mean the saving to the country of thousands of young pigs, besides greatly increasing profits by making feeding more effective.

SEED-TESTING AND CONTROL IN UNITED STATES.

MR. A. H. Cockayne, Biologist to the Department, makes the following remarks on this subject in his annual report for 1919-20:—

"While in the United States last year I paid considerable attention to seed-testing methods in vogue there, and also studied the effect of many of the seed laws that are in operation. With regard to seed-testing, great care is taken that lines reported on are extremely carefully sampled. This is a matter requiring considerable attention on the part of merchants here. Many if not all the discrepancies arising in the germination of such seeds as cocksfoot, Chewings fescue, and the like are due to the sending into the laboratory of samples carelessly sampled and not truly representative of the line in question. I found this same defect had been quite common in the seed-testing work of many of the States, but seed-merchants there now recognize that the laboratory test is true only of the samples submitted, and if not sampled properly may give quite an erroneous result so far as the whole line is concerned.

"Very special emphasis is given in the United States on the control of imported seed, and unless lines come within the standards of real value—*i.e.*, certain definite percentages of purity and germination—such seed is not allowed to be sold. Some similar method of control of imported seed should operate in New Zealand, and this phase of the question has been embodied in a Seeds Bill which has now been prepared."

MARTON EXPERIMENTAL AREA.

NOTES ON OPERATIONS, 1919-20.

J. W. DEEM, Field Instructor, Wanganui.

THE weather during the 1919-20 season was very unsatisfactory for working the Marton Experimental Area, rain falling with great regularity, which greatly delayed all farm operations, harvest-work being especially trying.

The crops grown consisted of 9 acres Algerian oats, 1 acre Ruakura oats, 9 acres wheat (six varieties), $8\frac{1}{2}$ acres skinless barley (two varieties), 11 acres peas (five varieties), 1 acre millet (seven varieties), $\frac{1}{2}$ acre Sudan grass, 2 acres swedes (thirty varieties), 2 acres turnips (fifteen varieties), $1\frac{1}{2}$ acres rape, 1 acre kale (six varieties), and 1 acre potatoes. In addition to these another acre of lucerne was established, half Marlborough and half Grimm varieties.

The wheat was sown on 5th and 6th September, and harvested between 29th January and 11th February. As was the case last year, Major gave the heaviest yield—namely, 56 bushels per acre; Purple-straw Tuscan was second with 44 bushels, and John Brown lowest with 29 bushels. The latter variety was the first ripe and suffered to some extent by birds, it being estimated that they took between five and six bushels per acre.

The barleys—Black and Brown Skinless—were grown on a wet paddock that could not be worked early. Sowing was done on 31st October, and the crop was ready to cut at the end of January, these barleys thus maintaining their reputation for rapid maturity. The Black variety threshed 48 bushels and the Brown 36 bushels per acre.

The peas were grown to build up the fertility and help to clean a field, recently taken over by the Department, which was badly infested with couch (*Agrostis stolonifera*). Most of the peas made very heavy growth, but bad weather prevented them being harvested in good condition. The varieties grown were Blue Imperial, Partridge, Stratagem, Arthur, and Canadian Field. All except Stratagem did good work in smothering couch, but the best were Canadian Field and Partridge, the former showing to special advantage. It is intended to try the effects of the Canadian Field variety on another very couchy paddock this year. In another field badly infested with spurrey (*Spergula arvensis*) and red-shank (*Polygonum Persicaria*) peas *versus* rape were tested for smothering, sown at the end of November. The peas came away fast and completely controlled the weeds, while the rape was badly infested.

A feeding experiment, peas *versus* rape, was also carried out on this area. There were 2 acres of peas and 1 of rape. A line of 150 lambs was divided, 50 put on the rape and 100 on the peas. The weather during the first two weeks of the experiment was very wet, and as no run-off could be provided the peas were tramped down flat and the lambs did badly, and it was thought the experiment would have to be abandoned. However, at the end of a fortnight

the weather took up and the test was continued. At the end of twenty-five days the rape was finished, and the lambs off both the rape and the peas were weighed. The rape lambs showed a gain of 6.2 lb. per head, while the pea lambs showed a loss of 0.46 lb. As there were still a good many peas on the ground, and the lambs appeared to be doing better, it was decided to put them back on the peas for another week, when they were again weighed and showed a gain of 2.58 lb. per head. In each case the lambs were penned up fifteen hours before being weighed. Three points strongly brought out were that lambs feeding off peas should be provided with a run-off for the first week or two, that they should have plenty of clean drinking-water, and that they should not be turned on to the peas until the bulk of the peas are firm and getting ripe. In the present case they appeared to do best after the ripe peas had fallen to the ground. It is intended to repeat this experiment during the season now commencing.

The millets gave heavy cutting, Japanese and Hungarian being the best. The former was ready to cut a fortnight before the latter. Sudan grass was ready before any of the millets, and gave the most forage with a good second growth. Stock also preferred it to the millets, although all were relished.

In the potato test New Era proved the best, standing up and producing a good crop, while the others were blighted.

The swedes were tested for disease-resistance. There was no club-root, but many of the varieties showed nodular growths. All varieties were attacked by dry-rot, ranging from 17 to 73 per cent. of affected roots at time of recording. A piece of very weedy land was selected, and a test carried out in swede-growing practice—ridging 28 in. drills *versus* sowing on the flat in 14 in. drills with ordinary drill. The ridged area was horse-hoed twice and the weeds fairly well controlled. The ridged crops weighed 29 tons 19 cwt. per acre, against 9 tons 14 cwt. on the 14-in.-drills area. The swedes on the former area were well developed and grew well out of the ground, and were in good condition for feeding off in wet weather, while those in the 14 in. drills, which had no after-cultivation, were smothered in weeds (that seeded), were small and of poor quality, deep in the ground, and hard to feed off by sheep. A strong point in favour of the ridging on heavy land like that about Marton is that when the land is wet the ridged swedes stand up dry and clean, while those on the flat are fouled, and sheep get in a very dirty state feeding on them, especially in wet weather.

In the turnip varieties, Lincolnshire Red Globe, Hardy Green Globe, and Vilmorin's Purple-top White Globe gave the best results.

Five acres of temporary pasture—Italian rye-grass and red clover—was closed on 1st October and cut for hay, being saved under fair conditions. The green and pressed weights are of interest. The first cutting, on 19th December, was mostly rye-grass. Several definite areas were weighed, and the crops averaged 7 tons 14 cwt. per acre, or a total for the 5 acres of 37 tons 14 cwt., which, when pressed three months later, turned out 9½ tons of hay. The field was cut again on 16th February, when the cut was practically all red clover, green weight 7 tons 15 cwt. per acre, total 37 tons 15 cwt., which pressed out 8 tons of hay, giving for the two cuts an average

return of approximately 3 tons 10½ cwt. of hay per acre for the period 1st October to 16th February. It should be mentioned that this field carried 135 sheep all through September, and was ready for grazing again at the end of February.

A feeding experiment to test palatability was also carried out with 1 acre of fodder crops consisting of rape, Green-top Aberdeen turnips, chou moellier (marrow-stem kale, green varieties), chou moellier (marrow-stem kale, red varieties), and Thousand-headed kale. The acre carried fifty lambs for a month, and they preferred the fodders in the order named, practically eating them in this rotation. The lambs showed an average gain of 7.32 lb. per head for the thirty days.

CALF-REARING TESTS AT EXPERIMENTAL FARMS.

THE many dairy-farmers and others who perused the account of the calf-rearing experiments conducted at the Department's experimental farms, published in the *Journal* for May last, will be interested to learn that the whole of the four groups of calves reared at Weraroa were wintered on the farm with the object of observing the constitutional after-effect of the different foods on these animals during that period.

The Farm Manager, Mr. W. J. McCulloch, reports that all the calves came through very successfully. The animals were weighed on 16th August, with the following results :—

Group 1 (flour and linseed-meal) : Total weight, 1,610 lb. ; average gain of each calf (four) since close of test, 157¾ lb.

Group 2 (crushed oats) : Total weight, 1,687 lb. ; average gain of each calf, 146¼ lb.

Group 3 (linseed gruel) : Total weight, 1,701 lb. ; average gain of each calf, 167¼ lb.

Group 4 (bean-meal and linseed-meal) : Total weight, 1,932 lb. ; average gain of each calf, 144¼ lb.

(Artificial foods only are indicated above. For details of dietary see May *Journal*.)

The animals were not nursed in any way during the period since weaning in March last ; indeed, until the last three or four weeks before weighing they had neither hay nor roots. The stock were subsequently sold in the local yards, and it was widely remarked that they were the healthiest, best-grown, and best-conditioned animals for their age offered at the sale.

In regard to the Ruakura trials, some of the calves were disposed of after the close of the tests. The remainder, however, are still on the farm, and have done just as well as the Weraroa animals.

It may be mentioned that another series of calf-feeding experiments has been commenced this season at Ruakura, Weraroa, and Mounahaki, with sundry variations suggested by last season's experience.

LEAF-STEM GALL-APHIS OF THE POPLAR.

DAVID MILLER, Entomologist.

LAST March specimens of galls infesting the leaf-petioles of poplar-trees in Central Otago were collected by Mr. J. Law, of Ranfurly, and forwarded for identification. On examination it was found that these galls were the work of the poplar-gall-aphis (*Pemphigus populi-trans-*

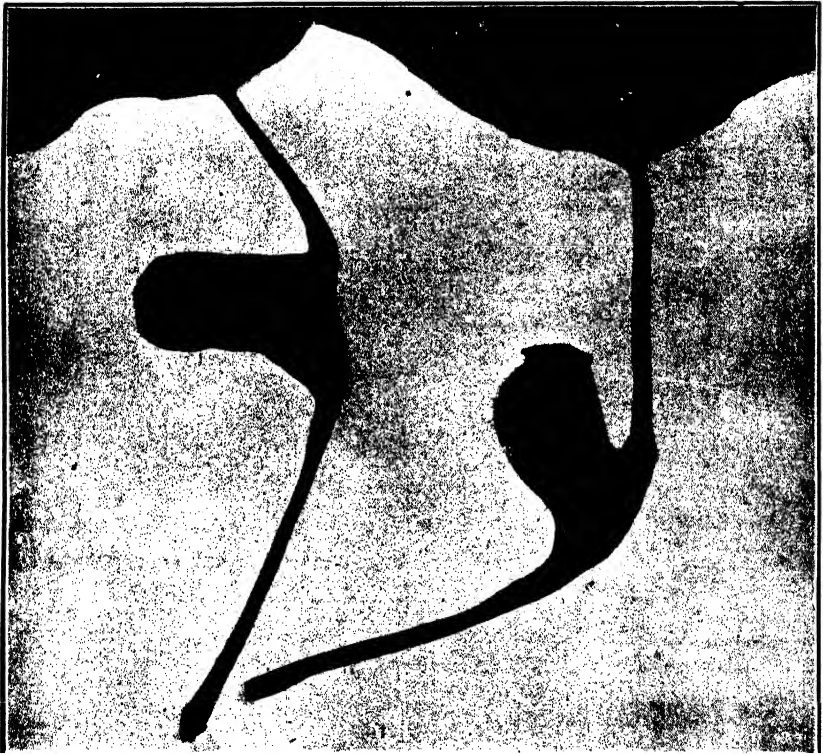


FIG. 1. GALLS OF PEMPHIGUS POPULI-TRANSVERSUS UPON LEAF-STEMS OF POPLAR.
Magnified about twice.

[Photo, E. Bruce Levy.

versus Riley), a species frequently found upon poplar-trees in North America. This insect is of some interest to agriculturists, since it not merely infests poplar-trees but has also been recorded from the roots of cruciferous plants.

The full-grown gall upon the poplar (Fig. 1) measures anything from $\frac{1}{2}$ in. to 1 in. in length, and resembles a sack in outline, though some

are more or less globular; the walls are thick and tough with the outer surface wrinkled, while at the end toward one side is a slit-like or sometimes circular opening surrounded by a thickened lip-like rim. Within the gall is a mass of white flocculent secretion exuded by large numbers of aphides, which are wingless females only and give birth to living young.

During the summer, and particularly toward the end of autumn, winged females appear among the wingless forms and escape through the opening of the gall. The body and legs of these females are black, the abdomen yellowish, and the wings grey and slightly clouded, with a blackish area along the front edge (Fig. 2). On leaving the gall they migrate to the leaves of cruciferous plants, such as rape, cabbage, mustard, and turnips, and several weeds allied to these cultivated forms, where they give birth to living wingless females. These in turn move from the leaves on to the roots of the food plants, and establish thereon a colony of yellowish wingless forms. The subterranean colonies can be readily located on account of patches of woolly secretion which the insects exude upon the roots of infested plants. Although these insects live on the roots of cruciferous crops as well as weeds, normally they cause no appreciable damage, but the loss would be considerable if the infestation became at all severe.

Winged females, similar to those developing from the poplar-galls in the autumn, issue from the root colonies in the spring and return to the poplar-trees, where they give birth to living males and females, both of which are wingless. This is the only stage in the life-cycle of the insect when males appear. The female in this case is very small, with a light-yellow body and paler legs, while the male is smaller still and of a delicate green colour. In due course the females deposit their minute yellowish-white eggs in some crevice upon the bark, and the young wingless yellowish-green forms hatching therefrom move on to the leaf-petioles, where they form the galls from which the winged females emerge in the autumn and migrate back to cruciferous plants.

When the aphid settles to form its gall the leaf-petiole commences to thicken, and curves to one side at this point. The thickening continues to swell until the fully mature gall is formed in late summer and through the autumn.



FIG. 2. WINGED FEMALE OF PEMP-
PHIGUS POPULI-
TRANSVERSUS.

Small figure on
bottom left is
natural size.

[Drawing by D. Miller.

Pasteurization in Cheesemaking.—The annual report of the Dairy Division for 1919-20 states that the demand for regenerative pasteurizing-machines—which is invariably the type used—has been greater than the supply. As additional plants are imported or manufactured locally they are eagerly purchased by dairy companies which have decided to adopt this system of treating the milk for the manufacture of cheese. The number of factories at which these machines had already been provided was 155, and the total quantity of cheese manufactured from pasteurized milk amounted to 32,200 tons, equivalent to 53 per cent. of the year's production.

POULTRY-FEEDING: MEAT *versus* NO MEAT.

F. C. BROWN, Chief Poultry Instructor.

A FEEDING-TEST has been carried out at the Department's Milton Poultry-station for the purpose of ascertaining as far as possible the effect of meat-meal on egg-yield. Twenty-four White Leghorn pullets of even type and of the same age were selected for the test and divided into four pens of six each. The ingredients of the ration provided to each pen were similar in every respect, excepting that meat-meal was included in the case of two of the pens (3 and 4). The test extended over a period of fifty-two weeks, commencing on 8th April, 1919. The results in egg-yield and in cost of food consumed by each bird are given in the following tables:—

Pens 1 and 2 (no Meat).

	£	s.	d.	£	s.	d.
Ground wheat, 332 lb., at 6s. 8d. per bushel ..	..	1	16	10		
Cost of grinding .. .. .	..	0	2	6		
					1	19 4
Pollard, 108 lb., at £9 5s. per ton .. .. .	..			0	10	0
Bran, 218 lb., at £7 5s. per ton .. .. .	..			0	15	10
Whole wheat, 652 lb., at 6s. 8d. per bushel ..	..			3	12	6
Cost of feed for twelve birds .. .. .	..			6	17	8
Cost of feed for one bird .. .. .	..			0	11	6

Pens 3 and 4 (Meat-fed).

	£	s.	d.	£	s.	d.
Ground wheat, 342 lb., at 6s. 8d. per bushel ..	..	1	18	0		
Cost of grinding .. .. .	..	0	2	8		
					2	0 8
Pollard, 108 lb., at £9 5s. per ton .. .. .	..			0	10	0
Bran, 225 lb., at £7 5s. per ton .. .. .	..			0	16	4
Meat-meal in mash, 45 lb., at £1 per 100 lb. .	..			0	9	0
Meat-meal kept in front of birds, 51½ lb., at £1 per 100 lb.	..			0	10	4
Whole wheat, 668 lb., at 6s. 8d. per bushel ..	..			3	14	2
Cost of feed for twelve birds .. .. .	..			8	0	6
Cost of feed for one bird .. .. .	..			0	13	4½

Pen.	Number of Eggs produced.	Cost of Food per Bird (Wholesale Rates).	Average Number of Eggs per Bird.	Amount received per Bird for Eggs at 2s. 2d. per Dozen.	Surplus over Cost of Food per Bird.
		£ s. d.		£ s. d.	£ s. d.
1 ..	1,257	0 11 6	209½	1 17 10	1 6 4
2 ..	1,294	0 11 6	215½	1 19 0	1 7 6
3 ..	1,482	0 13 4½	247	2 4 7	1 11 2½
4 ..	1,605	0 13 4½	267½	2 8 4	1 14 11½

Examining the results, it is worthy of note that while pens 3 and 4 produced the most eggs, they also cost the most to feed. It would appear that the inclusion of meat-meal in the mash makes it more appetising, and results in increased consumption. A total of 96½ lb. of meat-meal was consumed by the twelve birds, 45 lb. of which was included in the morning mash and 51½ lb. eaten from hoppers, where it was always available for the birds to pick at. The meat-fed birds cost 1s. 10d. a bird more to feed than the non-meat pens, but against this they produced an average of forty-five more eggs each. At the average market price available this shows an extra return for the meat-fed birds of 8s. 1d. each, or an extra profit of 6s. 2d. each, which indicates that the addition of animal food to the ration not only increases the egg-yield but the net profit as well. The cost of food for each bird is based on the wholesale ruling rates when the materials were bought. No charge has been made for cartage, or for green food and grit supplied.

The test is being continued for another year, but the rations have been reversed, pens 1 and 2 now receiving meat-meal, while pens 3 and 4 have none.

FIRE - BLIGHT.

NOTES FOR FRUITGROWERS.

G. H. CUNNINGHAM, Biology Section.

THE fruit-tree disease known as "fire-blight," which made its appearance in several districts of the Auckland Province last season, is a bacterial affection caused by *Bacillus amylovorus*. Bacteria are minute plants, which, lacking the green colouring-matter (chlorophyll) of higher plants, have of necessity to live on the elaborated food already prepared by higher plants or animals, as they are unable to elaborate these complex foods necessary for their growth. They may live on dead organic matter, or may attack living plants or animals, and so cause diseases of various kinds.

Bacillus amylovorus gains entry to the host plant in various ways, which are dealt with more fully later on. Once in the tissues it migrates to the intercellular spaces some distance above and below the point of entry. As bacteria increase very rapidly (it has been estimated that under favourable conditions the progeny of a single bacterium would amount to 16,500,000 in twenty-four hours) the diseased areas soon increase in size. In point of fact, the organisms are usually in the tissues in advance of the visible diseased areas. In the tissues the organism plasmolyses individual cells by extracting the moisture from the cell-sap, &c., the protoplasm of the cell soon drying in consequence. So far as is known the organism does not secrete a toxin.

Bacteria can only multiply and perform their various life functions under the influence of an equable temperature, the optimum for *B. amylovorus* being 25° - 30° C. If the temperature rises consider-

ably above this (40° – 43° C.) bacteria are quickly killed. When cooler weather sets in (late autumn) those organisms of *B. amylovorus* remaining in the plant-tissues become quiescent and remain inactive until the return of warm weather in the succeeding spring. No spores are found, however.

THE OOZE PERIOD.

On the approach of spring the bacilli in the larger cankered areas (they do not, as a rule, remain visible in the smaller shoots) become active and begin to multiply with rapidity. They increase in numbers so rapidly and plasmolyse the cell-contents to such an extent that large masses of a sticky substance (which consists of cell-sap and bacilli) are forced through the epidermis to the surface. This is the ooze period, and is the most serious to the orchardist, as it is from these exuded masses that the disease is spread each spring.

Insects readily devour this ooze, and carry away attached to their legs, probosces, &c., enormous numbers of the organisms. If the insect chances to visit the flower of a pear, apple, quince, &c., the organisms are released in the calyx-cup and readily make their way into the tissues of the nectary.

FLOWER-INFECTION.

With us the flower-infection stage has been the most serious of all, as the grower loses not only the present crop, but has a badly infected tree on his hands to deal with. Flower-infection is spread by insects, which visit first the ooze of cankers, then the flowers, spreading the bacteria from flower to flower until all the blossoms on the tree may be infected. These blossoms quickly turn brown, wither, and die, but remain attached to the spurs on which they are borne. They become very noticeable as grey dead patches among the young green foliage of the tree. The organisms migrate down the stalk of the blossom into the spurs, and from there into the tissues of the bark. Here they quickly spread out in a circular manner, gradually forming cankered areas, which increase until the whole branch may be ring-barked.

If a branch is ring-barked it wilts suddenly, the leaves change colour and shrivel, finally turning dark brown, but they remain persistent. Sometimes the whole of the top growth of the tree may appear as if scorched. This is largely due to the fact that most of the smaller limbs have been ring-barked. It is from this scorched appearance of the trees that the disease has obtained its name.

CANKER FORMATION AND TREATMENT.

Later in the season green aphid makes its appearance, and spreads the disease on to the young growing shoots. They quickly turn brown and curl up at the top in a most characteristic manner. These shoots die back for a distance of 5 in. or 6 in., forming a definite canker at the junction with the new wood. It is advisable to cut out all such shoots as soon as they make their appearance.

It is obvious that the source of the disease each season is these cankers, which as soon as they begin to ooze are visited by insects, which in turn carry the disease to young flowers. Remedial measures, therefore, lie in the cutting-out of cankered areas. Where small,

the whole affected branch is better cut out. If the canker is low down on a main limb, and the grower wishes to save the limb, he may rid the tree by cutting away the bark down to wood for a distance of 3 in. above and below the outside visible edge of the canker. The wood should then be painted over with formalin solution, 1-20 (1 part formalin to 20 parts water). Knives, &c., used in cutting should be sterilized after each cut by wiping the blade with a swab of cotton-wool dipped in the 1-20 solution. The wound should then receive a dressing of creosote and tar mixed to the consistency of ordinary paint.

NOTE.—Remarks on the fire-blight campaign will be found at the head of the "Orchard" monthly notes in this issue.

ENSILAGE-MAKING AT STRATFORD MODEL DAIRY FARM.

A. J. GLASSON, Fields Instructor, Hawera.

THE variable weather conditions of central Taranaki are, as a rule, not suitable for haymaking, and the difficulties experienced in previous years were mainly responsible for the management of the Stratford Model Dairy Farm deciding to make ensilage during last season.

The previous season's turnip and mangold ground, $8\frac{1}{2}$ acres, was prepared and sown on 20th October in ensilage crops, as follows: $1\frac{1}{2}$ acres, Bobs wheat 2 bushels, and tares 1 bushel, per acre; 2 acres, Algerian oats 2 bushels, and Partridge peas 1 bushel, per acre; $1\frac{3}{4}$ acres, Algerian oats 2 bushels, and tares 1 bushel, per acre; $1\frac{3}{4}$ acres, Algerian oats 2 bushels, and tares $\frac{1}{2}$ bushel, per acre; $1\frac{1}{2}$ acres, Algerian oats 2 bushels, and tares $\frac{1}{2}$ bushel, per acre. The manure used was basic super, at 2 cwt. per acre.

The crops were all well up by the end of the month. The wheat came away faster than the oats, and the tares made better growth with the wheat than in the oat crops. The crops were ready for making into ensilage the first week in February, the grain then being in the putty stage, the peas podding, and the tares in bloom and coming to pod.

Cutting was started on 10th February. Two flat-top sledges were used for carting material to the stack, and the stacking was done with a mast and yard-arm and grapple hayfork worked by horse-power. The men employed were as follows: One on the mower, two to each sledge, two on the stack, one at the derrick, and a boy to lead the horse. The ground-measurement of the stack was 18 ft. by 17 ft. The first day's work built the stack up to 6 ft.; and on the 11th it was raised to 12 ft. 6 in. No work was done on the 12th, and on the morning of the 13th the stack had sunk to 9 ft., with temperature 120° F. On this date more material was added, and the stack rose to 16 ft. To give the stack time to settle down and develop the required temperature no work was done on the 14th and 15th. On the 16th the stack had receded to 10 ft., with temperature 140° . Material was added, and the stack rose again to 17 ft. 6 in. Bad weather then set in and rain fell almost continuously, making further work impossible until the 20th.

By this time the stack had sunk to 11 ft., with a temperature of 130°, but the silage had suffered no ill effects, the heavy rains having kept the temperature down. Material was then put on until the stack was 18 ft. high, and on the 21st it was weighted with 12 in. to 15 in. of earth. An amount of 4 cwt. of salt was used in making the silage.

Weights of the various green crops were taken, which worked out as follows: Wheat and tares, 13½ tons per acre; oats and partridge peas, 11½ tons; oats and tares, 11½ tons; and oats with reduced quantity of tares, 9 tons; or an average of 11½ tons per acre over the whole area. Thus the green weight of material put into the stack was approximately 95 tons.

The stack was opened on 19th July, and cut out a sweet good-quality silage. The settled dimensions of the stack were 20 ft. by 18 ft. by 7½ ft., equalling 2,700 cubic ft., and the weight per cubic foot was 44 lb., or a total of 53 tons of ensilage. Allowing each cow a daily ration of 30 lb., this would feed a herd of forty cows for ninety-nine days.

FIELD-PEAS FOR FATTENING LAMBS.

T. W. LONSDALE, Manager, Moumahaki Experimental Farm.

IN most parts of the Dominion rape is the principal forage grown for fattening lambs, but as on many old-established holdings the raising of a profitable crop of rape has become somewhat precarious it is being found necessary to substitute other fodders, and undoubtedly one which will eventually take a prominent place is peas.

The writer has always been an advocate of peas as a crop that should find a place on almost all arable land, and a short preliminary trial of the fattening-qualities of peas and rape respectively was carried out at this station last summer. Rape was sown on 15th October, and on the same day an adjoining plot of equal area was drilled with Partridge peas, both plots receiving similar treatment with regard to preparation and manures. On 2nd February a line of crossbred lambs by South-down rams was divided, and after marking and weighing equal numbers were placed on each plot. Previous to this date the lambs had not received any artificial food, but had been running on fresh pasture from weaning. The following shows the dates of weighing and average live weight per lamb:—

Lot 1 (rape): 2nd February, 58.65 lb.; 15th February, 65.80 lb.; 22nd February, 68.60 lb. Average gain per lamb, 9.41 lb.

Lot 2 (peas): 2nd February, 56.35 lb.; 15th February, 60.40 lb.; 22nd February, 69.30 lb. Average gain per lamb, 12.68 lb.

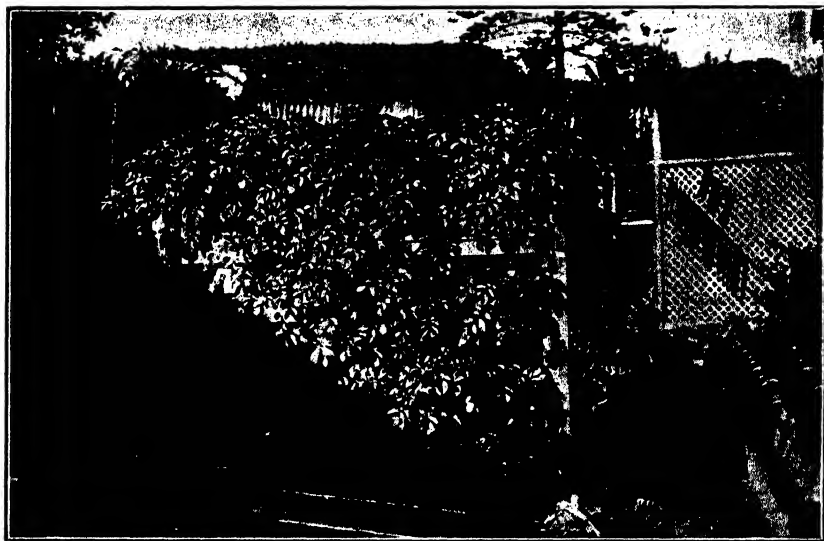
Gain in favour of peas, 3.27 lb. per head.

The lambs on rape made most headway during the first two weeks, which is accounted for by the lambs in lot 2 not taking so readily to peas, but the gain in weight of this lot during the third and final weeks was remarkable.

Preparations are being made to conduct a similar test on more extensive lines during the present season.

POTATO - GROWING IN LAYERS.

SEVERAL inquiries have been received lately regarding the growing of potatoes on the intensive system of layers, to suit conditions where only a very limited area of ground is available. A brief account of an experiment with this method by Mr. Gerald Fitzgerald, of Wellington, carried out last season in his back garden, in Tinakori Road, may therefore be of interest, although the result was largely of a negative character.



THE POTATO-GROWING CRATE IN MR. FITZGERALD'S GARDEN.

[Photo, B. C. Aston.]

The potatoes were grown in what is practically a wooden crate in layers, each layer of the potatoes being separated by a layer of earth. In this way the potatoes grow outwards and upwards. The dimensions of the crate were 6 ft. by 6 ft. square and 4 ft. high; timber used was 3 in. by 3 in. totara posts for the upright corners, and the side battens were 3 in. by 1½ in. totara set on edge, leaving, therefore, 3 in. spaces through which the shaws of the potatoes grew. In sowing the potatoes the layer of earth occupied so much space that only the alternate spaces were occupied by the protruding shaws.

The sets were placed 6 in. from the sides, and were otherwise 12 in. apart. The whole was filled (in August, 1919) with layer after layer of soil and potatoes, with a light sprinkling of sulphate of potash. The soil was in good condition, neither too wet nor too dry. The

weight of the seed-potatoes was 28 lb., and the variety used was Sutton's Supreme, an early sort.

The crop was taken on 8th February. A slight second growth had been started. The total yield was 88 lb. Half of this came from the top layer—a large yield—and the balance from the outside sets in the several underlying layers. The inner sets produced nothing, some of them had disappeared, and a few had remained without movement. The quality of the yield was excellent—mostly large well-found tubers, and a few small ones—indicating that the soil was good and the cultivation suitable. The labour of making and discharging the crate, however, made the crop unprofitable, and this method of potato-growing is not recommended by the grower or the Department.

A good general idea of the crate and growing crop is given by the accompanying photograph.

SHEEP-MANAGEMENT NOTES.

II. CASTRATION AND DOCKING OF LAMBS.

F. MACKENZIE, Inspector of Stock, Christchurch.

THE castrating and docking of lambs is an important yearly procedure on farms where sheep are bred. There are various methods employed in different districts—in fact, as regards details, most sheep-farmers have their own methods of castrating lambs.

Ground and Location.—One of the most important factors connected with these operations is to have the work carried out on clean ground, and under no consideration should the lambs be marked on the same ground two years in succession. The reason for this precaution is that the ground is soiled with blood, and consequently becomes a propagating-ground for bacteria, especially the bacteria which cause blood-poisoning or septicæmia. The bacteria of tetanus, or lockjaw, must also be similarly guarded against.

The most suitable place is a clean grass-paddock, high-lying and well exposed to the sun. Low-lying and damp places should be avoided as far as possible. All bacteria must have moisture to keep them alive and multiplying, so that if the ground where the operation is carried out is wet or damp it may become a veritable incubator for the bacteria. On the other hand, ground in a high and dry position, well exposed to the sun, soon becomes clean, the sun's rays being the best disinfectant we have. On damp ground the moisture protects the disease organisms from the direct action of the sun's rays.

Conditions and Preparation.—Lambs should be castrated and docked when from three weeks to a month old. Marking lambs during the heat of the day or while heavy warm winds are blowing should be avoided as far as possible. The cool of the afternoon is the best time to carry out the work. For marking operations a few hurdles and coils of wire netting, together with a sufficient number of stakes,

should be held in readiness. With these a pen and yard can be erected in a suitable part of the paddock where the ewes and lambs are to be folded.

The instruments required consist of two clean, sharp knives, together with a bucket of water to which has been added some disinfectant. The hands of the person operating should be well scrubbed in a solution of the disinfectant before commencing operations. The knife when not in use should be placed in the bucket containing the antiseptic solution.

The Operation.—The method most often employed is as follows: The lamb is held by an assistant in such a position as to expose the pouch. The operator grasps the pouch at the tip and with one clean cut severs the end. The testicles are then pressed out and drawn. This is generally done with the teeth, but some operators prefer drawing the testicles with the fingers. If the cord should happen to be broken by rough handling before the testicle is properly drawn bleeding will be the result, and the blood collects in the pouch. This must be removed and the pouch washed out with an antiseptic solution. The reason for this is that if a blood-clot collects in the pouch septicæmia supervenes, and death follows. The testicles and pouch-ends should be placed in a receptacle provided for this purpose. As soon as castration is completed the tail is grasped and severed with one clean cut. The cut is best made two or three joints from the stump; the joint can be felt by the finger and thumb. A weak disinfectant should be applied to the wounds before releasing the lamb.

The knife used for tailing should be a separate one from that used for opening the pouch. The knives and operator's hands should be dipped into the antiseptic after each operation. After the work is concluded the tails, testicles, and pouch-ends should be collected and destroyed by fire.

After-care.—When marking operations are finished the ewes and lambs should be placed on good clean pasture with sufficient growth to keep the lambs' tails or pouch-ends from coming into contact with the soil. If these precautions are strictly observed any mortality from castration and docking should be reduced to a minimum.

Bleaching of Phormium - fibre.—During the past year a sulphur bleaching process has been tried at a few of the flax-mills in the Dominion, with the object of substituting it for the usual open-air bleaching. So far, however, the new process has not been as successful as anticipated.

Transmission of Earmarks.—Mr. J. W. Taylor, of Silverstream, reported last month the birth of a calf with its mother's earmarks, and this was confirmed by one of the Department's veterinarians who visited the farm. Such cases are of sufficient rarity to merit record. Similar occurrences have been previously noticed in the *Journal* for July, 1914, and September, 1916, the latter relating to the transmission of the earmarks of a bull to several of his progeny.

WORK FOR THE COMING MONTH.

THE ORCHARD.

FIRE-BLIGHT control work in the Auckland Province has been again taken up, and is under the general control of Mr. W. T. Goodwin, Orchard Instructor. All available permanent officers from the different parts of the country have been assembled and have been working in the affected areas, together with a number of temporary men. Up to the present this work has been in the nature of going over the ground previously covered (last summer and autumn), checking the work, removing infected and doubtful wood that may have been overlooked, and otherwise destroying all sources of infection as completely as possible. No indication of how successful the work has been is yet available, but the danger period is almost at hand, and with the blossoming of apple and pear trees the prospects of the immediate control or otherwise of the disease should be readily ascertainable.

Should an outbreak occur despite the work which has been done—and this is quite possible, owing to the average class of tree in the affected areas being such as to render detection difficult without careful search—the extent of such outbreak will largely determine the future policy. Should the outbreak be general, resembling that of last year, the staff will be immediately concentrated on the outskirts with a view to preventing its spread further afield. In the meantime the matter of more drastic action regarding the affected area will be determined; but should isolated outbreaks only occur the aim will be to immediately remove the affected parts of the trees attacked, and at the same time locate and remove the source of infection. In such cases this may be expected to be found in the form of a canker of the previous year's infection which has escaped detection.

Growers are earnestly requested to assist the departmental officers in stamping out the disease. Information as to how such assistance can be given (by cutting out and destroying cankered areas and disinfecting) may be gathered from a perusal of the article on fire-blight appearing elsewhere in this issue. Immediate notification of any outbreak should also be given to the local Orchard Instructor.

—J. A. Campbell, *Assistant Director of the Horticulture Division.*

AUCKLAND.

Cultivation: It is imperative that the plough be got to work at the earliest opportunity. The heavy growth of *Lotus angustissimus* experienced annually in the orchards in the northern districts makes this essential, and should the spring prove to be dry the work is only accomplished with difficulty.

Spraying stone-fruits: The early spring application will now have been completed. It is desirable in cases where brown-rot has been prevalent that an application of bordeaux, 3-4-40, or commercial lime-sulphur, 1-120, should be got on just at the time when three-fourths of the blossom-petals have fallen. The bordeaux is only recommended as a spray just at this period, and must be applied immediately at the time stated or not at all. Judicious thinning of stone-fruits is recommended as essential in materially lessening brown-rot.

Spraying pip-fruits: It is necessary to closely watch opportunity throughout this month to apply the first bud-movement spray, bordeaux 8-6-40, for control of fungoid troubles. This must be followed by bordeaux, 6-4-50, at the cluster-bud stage, and again later with bordeaux, 3-4-40, with the first arsenate (calyx) spray for codlin-moth—one of the most important operations in the annual programme of growers of pip-fruits. For successfully carrying out this work a high pressure is needed to force the poison well into the calyx-cup. This application is carried out immediately the bloom-petals have fallen and while the calyx yet remains open.

It is noticeable that many orchardists are not as careful as they should be in the application of arsenate-of-lead sprays—this first calyx-spray in particular. The calyx-cups are pointing at this period in all directions, and a thorough method is necessary to ensure good results. Every cluster of young fruit must receive the spray, and to do this the man with the nozzle should spray each tree from the four points of the compass—taking a stand at each point, thoroughly spraying the branches immediately opposite him and those at the other side of the tree which are facing towards him.

Strawberries: Growers are advised to spray with bordeaux, 4-4-40, keeping the foliage covered, for control of leaf-spot.

Citrus fruits: Owing to the irregularity in the growth and consequently in the blossoming of citrus trees (especially lemons this year) growers must judge individual cases, and put on their bordeaux, 5-4-40, when the spring growth has hardened, or 4-4-40 if the fruit has set before the growth hardens off. The abnormally cold weather, with many heavy frosts, has caused much damage to citrus trees, more especially lemons, where no covering was afforded. Attention should be paid to all affected trees, and all frosted parts cut away to a bud or lateral growth. This work is important, as dead wood resulting from neglect to carry it out will afford abundant opportunity for the entry of borer.

Manures: It is not yet too late to apply nitrogenous and phosphatic manures, but they should be got on without further delay.

—J. W. Collard, *Orchard Instructor, Auckland.*

HAWKE'S BAY.

Spraying will be the chief work of the month. With apples and pears the application of a fungicide in the early stages of the fruit-development is very important for the control of black-spot. Varieties not inclined to russet should receive an application of bordeaux, 3-4-50, at petal-fall. Varieties known to russet should receive bordeaux, 6-4-50, or lime-sulphur, 1-30, at the open-cluster stage (see last month's notes).

Keep a close watch for the first appearance of red mite; hatching may be expected about the petal-fall period. Lime-sulphur, 1-100, will kill, but only on contact; therefore make a thorough spraying, as all mites which escape at this period will cause renewed trouble later. Lime-sulphur at this strength may be applied with the arsenate-of-lead spray, but fresh lime of equal weight to the arsenate used should be added to the mixture to safeguard against scorching.

For codlin-moth arsenate of lead, $1\frac{1}{2}$ lb. paste or 1 lb. powder to 50 gallons water, should be applied when the majority of the petals have fallen. Use good pressure and aim the spray towards the calyx-cup.

Most varieties of peaches will have set fruit, and spraying at this stage will consist of lime-sulphur, 1-125, as a precaution against brown-rot.

European varieties of plums should receive bordeaux, 6-4-50, at the cluster-bud stage to check the early development of rust. Japanese and hybrid varieties which have set fruit should be sprayed with lime-sulphur, 1-125.

Fire-blight: From the fall of bloom onward a lookout should be kept for fire-blight. Now that this disease has been found in the Auckland Province, orchardists in this district cannot afford to treat lightly any suspicious symptoms. With apple, pear, and quince all dead tips, twigs, spurs, or blossom-clusters, and bark eruptions or cankers, should be regarded with suspicion. With the aid of the growers it is hoped to promptly locate any sign of the trouble.

—W. H. Rice, *Orchard Instructor, Hastings.*

MOTUEKA.

Cultivation should be attended to and the soil kept in good tilth from now onwards. Cover-crops should be ploughed in where this has not already been done.

The fruit set will be well forward, and attention should be turned towards the prevention of diseases in the coming crop. The calyx-spray with arsenate of lead—using $1\frac{1}{2}$ lb. paste or $\frac{3}{4}$ lb. powder to 50 gallons—should not be neglected on apples and pears. The application should be made as soon as the petals have fallen and before the calyx closes. This spray should be applied at intervals of about three weeks throughout the growing season of the fruit.

Twigs infected with powdery mildew should be removed and burned, and the trees thoroughly sprayed with lime-sulphur, 1-100 to 1-120.

Stone-fruit should be given every attention to prevent the ravages of brown-rot. The application of lime-sulphur, 1-125, is recommended.

Red mite may be effectually controlled at this period by the use of lime-sulphur at the strengths recommended, and every effort should be made to cope with it.

For control of black-spot on pears bordeaux, 3-4-50, may be used to advantage, but on account of the russetting effect of bordeaux on apples when used at this stage lime-sulphur is recommended for the latter.

On account of the fire-blight outbreak in the northern parts of the Dominion local growers are recommended to bring under the notice of the Orchard Instructor for the district any suspicious signs that may be taken for this disease in their orchards.

—*W. T. Goodwin, Orchard Instructor, Motueka.*

CANTERBURY.

Cover-crops turned under as suggested in last month's notes should be thoroughly decayed by this time, and the cultivation of the land can be proceeded with. Any manuring required should be carried out as soon as possible if results are to be obtained this season.

Grafting may still be carried on, although it is getting rather late. Watch the grafts as the season advances and cut off any unnecessary or surplus shoots, leaving only those required for the building-up of the tree.

With the appearance of these notes the majority of stone-fruits will have set their fruits, and care must be exercised with regard to the spraying. Bordeaux, even at a weak strength, is liable to burn fruit and foliage; therefore from this time onward lime-sulphur, 1-125, or atomic sulphur, 10 lb. to 100 gallons water, should be used. Leaf-curl will probably be the worst disease to contend with, and it is necessary to apply the spray under good pressure, especially towards the tips of the branches, where the curl usually makes its first appearance. Lime-sulphur will also do much to keep red mite in check. Green aphid does not appear to be very troublesome in this district, but black aphid is usually bad all through the spring and summer. If neglected considerable damage is done to the young growths, causing them to curl and stop growing. Apply Blackleaf 40, at strength 1-1,000, as soon as the aphid is noticed, and repeat at short intervals until pest is eradicated.

This is the most important time of the year for spraying for fungus diseases, especially black-spot on apples and pears. Should there be any varieties still in the pink stage an application of bordeaux, 6-4-50, should be applied at once. This should be followed after the fruit has set with an application of bordeaux at strength 3-4-40. Varieties of apples subject to russetting, and where spot has not previously been bad, may be sprayed with lime-sulphur at strength 1-100, testing the lime-sulphur before using and diluting accordingly, but bordeaux will give the best results on pears. Arsenate of lead may be added to the fungicide sprays for the control of codlin-moth, using paste $1\frac{1}{2}$ lb., or powder $\frac{3}{4}$ lb., to 50 gallons. The addition of milk of lime (from 4 lb. to 5 lb. of fresh lime) will help to neutralize any free acid in the mixture and lessen the danger of burning. Should any powdery mildew be noticeable it would be advisable to cut off and burn the affected parts and spray with either lime-sulphur, 1-100, or atomic sulphur, 10 lb. to 100 gallons.

—*G. Stralford, Orchard Instructor, Christchurch.*

OTAGO.

Apple and pear trees will be in the pink stage of development by the end of September, and the treatment of the trees at this stage was fully dealt with in last month's notes. During October they will enter another phase, the blossoms will have fallen, and the young fruits commenced to form. Given suitable weather the air will be full of fungus spores of black-spot and powdery mildew, and fruit and foliage will need protecting from their attacks. Continue the applications of lime-sulphur, but at reduced strengths—1-80 to 1-100. Varieties such as Rome Beauty and Cleopatra are better for the greater strength owing to their predisposition to the disease and their comparatively good resistance to spray injury, but with most varieties it is well to reduce to 1-100 at this stage.

At this time the calyx of the fruit will not yet have closed, and the addition of arsenate of lead (paste or powder) to the fungicidal sprays is desirable in order to guard against codlin-moth. Though many consider this first application of arsenate of lead a waste in orchards comparatively free of codlin-moth, it is best to be on the safe side, especially in regard to early pears and apples, a large proportion of infected fruit being found to be attacked through the calyx. When using lime-sulphur and arsenate of lead in combination take care to dilute each compound separately with a good bulk of water, and then add together and apply

immediately, as chemical action sets up which is likely to cause damage if the mixture is allowed to remain too long in the tank before application. Standard brands of arsenate-of-lead paste give good results used at a strength of 3 lb. to 4 lb. to each 100 gallons of mixture, but only half this quantity of the powder is required.

Apple-trees will also need attention for the control of woolly aphid, colonies of which will begin to appear round the cuts and knots, especially where oil sprays have not been applied during the dormant period. Painting these parts with one part oil and two parts water will give good results; or add Blackleaf 40, at 1-800, to the fungicidal sprays and drive the spray well into cracks and crevices. Black and green aphid will also make their appearance about this time on peaches and nectarines; apply the Blackleaf spray, at 1-800, as soon as noticed, following up in a few days with another application. Very badly affected twigs are better removed and burned as soon as noticed, to avoid further infection.

Peach leaf-curl will be in evidence if weather is suitable to its development. It pays to pick off and destroy infected leaves and twigs to avoid its further spread and give the trees a chance to make new growths. Spraying with lime-sulphur, 1-140, will also help to check its spread, but stone-fruits are subject to scorch, and care must be exercised not to overdo this spraying on cropping trees.

As there were suspicions of brown-rot in the Teviot district during last season, I shall be glad if growers noticing any signs of this disease in their orchards will send notification of same at once, so that assistance and advice may be given in dealing with it. Any suspicious wilting or dying of pear-trees and apple-trees at blossoming and fruit-setting period should also be notified immediately, as this is one of the symptoms of the fire-blight disease now attacking fruit-trees in parts of the North Island.

—J. H. Thorp, Orchard Instructor, Dunedin.

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

THE end of October brings to a close the correct season for hatching out chickens of any breed. Therefore, if not already done, the last of the eggs should be put into the incubator or under broody hens at the earliest possible moment.

THE COLONY-HOUSE.

Where early hatching has been carried out the chickens will require to be moved from the brooder to the colony-house. In this connection every care should be taken to make the quarters fit to receive the young birds and to guard them against a set-back. See that the houses are thoroughly cleaned and sprayed with a good disinfectant, making sure at all times that no insect pests are present. Particularly does this apply to the red mite, which hides in cracks and crevices during the day and avoids any but the keenest observation. It attacks the birds at night by blood-sucking, and even adult stock cannot retain their health and vigour when being tortured with these parasites. It is therefore little wonder that young chickens cease to grow, and often die, when moved from the brooder to vermin-infested quarters. Lice of any kind should not be allowed to exist, particularly where young stock are concerned, and the only way of preventing these from making their appearance is by paying strict attention to cleanliness.

On no account allow the chickens to huddle in corners, or trouble may be surely anticipated. The huddling brings on sweating, and this makes the chickens susceptible to chill and colds immediately they go out-of-doors. It is common, but nevertheless a mistake, to try and harden the chickens off too rapidly after leaving the brooder. Any set-back at this stage means a serious check to healthy development. It stands to reason that when young chickens are taken from a cosy secluded brooder-quarter and placed in an open colony-house they will be encouraged to huddle in their endeavour to obtain the warmth and seclusion they have been accustomed to. When chickens are first put into a colony-house they should be provided with conditions similar to those they had in the brooder. A temporary hover should be provided, and arranged in such a way that the chickens can secure an ample supply of fresh air and at the same time be secluded. It is always a good plan to have the corners of a colony-house rounded off with wire netting, so that in the event of crowding the chickens at the back can secure fresh

air. For the first few nights the chickens require the most careful watching to see that the conditions are favourable to their development, especially when cold weather is being experienced. In addition to providing snug housing-quarters it is always well, where possible, to give the growing chicken a fresh run, preferably one that has been spelled for some time, and sown down with grass, clover, or rape, &c. Chickens will invariably thrive better on such a run than they will on stale ground.

COCKERELS AND PULLETS.

Do not neglect to separate the sexes as soon as possible. This will be to the advantage of both cockerels and pullets. It should not be forgotten that cockerels for the table and pullets intended for heavy egg-production require different treatment if the desired ends are to be achieved. The cockerels should be fed and managed in such a way that they will rapidly develop and be in a marketable condition at about four months and a half old. With this end in view, after the birds are three months old only soft food should be supplied. A mash composed of 50 lb. ground oats, 25 lb. ground wheat, 10 lb. maize, and 5 lb. meat-meal will make a suitable mixture. This should be moistened with milk or soup into a crumbly mass. Feed three to four times a day as much as the birds will clean up without waste. Green stuff, such as cabbage, lettuce, watercress, and chaffed lucerne or clover, &c., should be daily and liberally fed, while grit should be always in front of the birds to pick at. Where milk is available it should be given to drink in large quantities. As it is next to impossible to fatten cockerels on free range, they should be placed in confinement in a decent house, with a run giving opportunity for only limited exercise. The production of a maximum weight of flesh in a minimum period of time is the ideal to be aimed at when priming a table cockerel.

This is not the case with the growing pullet, which should be kept steadily growing and allowed to come to maturity in a natural way. Ample food should be provided, but not of a forcing nature, or the bird is apt to come to pre-maturity, and this is always undesirable. Meat, its substitutes, or skim-milk should be sparingly supplied. Indeed, when it is observed that pullets are showing signs of coming to maturity at too early an age these forcing-foods should be cut out of the ration. Good grain foods, of which crushed plump oats should form the bulk of the ration, together with an abundant supply of green material fed separately are the chief food-requirements of a growing pullet. It is not generally known that when a pullet commences to lay she ceases to grow. Obviously, if a bird commences to lay at a very early age it will be a diminutive specimen and a producer of undersized eggs. Generally speaking, it is better for a pullet not to lay before it is six months old.

THIN-SHELLED EGGS.

The production of thin-shelled eggs is a common occurrence at this season of the year. This is usually due to insufficient shell-forming material being supplied, or to the birds being overforced with meat, milk, &c., for egg-laying. As a preventive an ample supply of crushed oyster or other sea-shell should be always available for the birds to pick at. If this does not bring about the desired effect the only other safe course is to feed a less forcing ration.

THE APIARY.

G. V. WESTBROOKE, Apiary Instructor.

EXAMINING HIVES.

By this time all hives should have been carefully examined, and the condition of each duly noted. The objects of such examination should be to see that the bees have sufficient stores, a laying-queen, and freedom from disease. If on examination it is found that there is but little honey in the hive it will be necessary to feed liberally. If the apiary is free from disease it may be advisable to remove frames of sealed honey from those hives which have more than sufficient to carry them through, giving them to those deficient in stores. If this honey is not available it will be necessary to resort to sugar-feeding. In feeding sugar-syrup the best method is to use the division-board feeder, placing it as near the cluster as possible in weak colonies, and using equal parts sugar and water.

If no eggs or brood are found in a hive at this time of the year it is most probable that the queen is missing. In such cases it is advisable to unite such a colony to a fairly strong hive. Do not attempt to unite two weak colonies. In uniting, one of the best methods is to remove the cover and mat of a fairly strong colony, and place over the top a double sheet of newspaper. Then remove the queenless colony from the bottom-board and place it over the newspaper, giving no outlet for the bees in the top box. This should be done in the evening when the bees are quiet. They will soon get through the paper, and usually will unite quietly. If it is desired to unite a weak colony that has a queen this method may also be adopted, but it is advisable in this case to first remove the poorer queen.

If disease, such as foul-brood, is found it is necessary to treat as advised last month. Do not delay treatment, as the longer it is left the less chance there is of the bees recovering in time to be ready for the honey-flow.

SPRING MANAGEMENT.

Spring management is perhaps the most important problem of the beekeeper. On it depends to a large extent whether a good surplus of honey will be secured or not. The principal object is to build up the colonies, so as to have the largest possible number of worker-bees flying just when the main honey-flow commences. The time of the honey-flow varies according to locality, and beekeepers will need to study local conditions. In order to bring the hives up to the required state it is often necessary to start stimulative feeding. In such cases use two parts of water to one of sugar, feeding frequently in small quantities.

A good plan for stimulative feeding is to adopt outdoor feeding, but this is not advisable where other bees are within two miles of the apiary, as if nearer they would participate in the feast. If, however, circumstances are favourable for outdoor feeding it is necessary to have a large shallow trough or tank in which is placed a light wooden grating to float, so that the bees may not be drowned. The syrup should be very light, about eight parts water to one part sugar. In order to start the bees on it the syrup may be made about five parts water to one part sugar, and when the bees are working freely the strength should be reduced. It is advisable to have the feeder about 2 or 3 chains from the apiary, and feeding should be continuous when once started; or, if it is desired to stop, the vessel should be removed when empty, as otherwise the bees are apt to commence fighting round the empty feeder when the syrup is no longer available. It is important in outdoor feeding to use only very weak syrup, as advised. Colonies so fed, if at all strong, will very quickly build up, and the next problem will be to prevent swarming.

The best method to check swarming is to requeen as early as possible with young queens, giving each hive plenty of ventilation and room to expand. Frequent examinations of the strong hives and cutting-out of queen-cells will be necessary. The question of queen-rearing may be deferred till next month's notes, as generally it is too early to commence before November, except in the warmer portions of the Auckland Province. Preparation, however, may be made by encouraging drone-production in Italian hives, and building up one or two hives to a populous condition for the purpose of raising queens, when the weather is suitable.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

If a succession of broccoli covering a long period is wanted a number of varieties should be sown. The varieties are separated into sections—early, mid-season, and late. The chief difference in the varieties is the length of time they take to grow, early varieties coming to head in a shorter time than later kinds. This habit might lead to the supposition that a succession might be had by sowing the same variety at different times. That, however, would not answer. Unless a certain amount of growth is made before short days set in the heads produced would be very small, because they would be the produce of imperfectly developed plants. The fact of some varieties taking a longer time to head than others enables the starting of all while growing-conditions are good, and thus perfect development

is secured in each variety. Sowing should commence with early varieties about 15th September, mid-season two or three weeks later, and late varieties about the last week in October.

Leeks should be sown at once in all places, in shallow drills for transplanting at the end of December. In the colder districts carrots, parsnips, and red beet should be sown at once for winter use. In the warmer parts this sowing should be delayed till the first week in November.

Brussels sprouts are the most popular of all winter vegetables. They require a long season of growth to give their best, and seed should be put in at once. The young plants should be pricked off into beds of good soil as soon as they can be easily handled, spacing them about 4 in. apart. Plant finally, as soon as the plants are large enough, in rows 3 ft. apart, 30 in. between the plants. Everything that can should be done to induce a strong and sturdy growth. A good development of side leaves is necessary to the production of good sprouts. The side leaves should on no account be cut off until the sprouts are gathered.

Young celery-plants should be pricked off as soon as they can be handled, the smaller the better. Boxes with a depth of $2\frac{1}{2}$ in. inside measurement are better than those that are deeper. Half fill the box with littery stable manure, and press it firmly down; then fill the box heaped measure with good rich compost, stroke it off with a lath, and press firm with a dry brick or piece of board. Prick the seedlings out 2 in. apart, well water, and place in semi-shade for a few days. Celериac requires the same treatment.

Tomato seedlings should have been pricked out before now. Keep them in full light if in a house, or near the glass if in frames. Well ventilate on fine days. If air passes directly through the plants it will be to their benefit. The object should be to grow the plants tough and strong; there must be no coddling.

Turnips for succession should be sown as wanted, allowing seven to eight weeks between each sowing. The best plan is to sow a fresh bed as soon as pulling from the last begins. Sow lettuce thinly in lines and thin the plants to about 9 in. apart. This is a better plan than transplanting in hot weather, as it saves a lot of watering. Sow peas for succession, and French beans for the first time.

Runner beans also should now be sown. Beans of the old scarlet-runner type are perennial plants and do not require planting every year. The number of years it is profitable to leave them depends on the soil and the treatment they get. If the soil is of a free nature it will remain in good condition for many years, and if the plants are well fed they can remain. A plant will die here and there, but this can be made good by planting a seed-bean in the gap. Usually it is most profitable to let them stand only two years. The second year should show an increased crop of beans, but less growth in haulm. To grow them well prepare a trench as if for celery, but use a fair quantity of lime forked well into the lower strata of soil as well as in the top layer. In place of stable manure as used for celery decayed garden refuse may be used with a little bonedust mixed with it and a dusting of lime. Fill the trench with soil to within 6 in. of the top. Plant the beans in two rows 1 ft. apart in each row. When the plants are up set the sticks firmly in the trench on each side, and when they have run a foot or so up the sticks fill more soil into the trench, but still leave it a little hollow to facilitate watering.

Seedling beds of onions that are far enough advanced should be thinned, an operation that must not be delayed. It is easiest performed while the plants are small, and early thinning promotes good growth. The distance apart to leave the plants depends on the size of bulb required as well as on the quality of the soil, and personal observation is necessary to determine what is best. But it may be said that for market purposes medium-sized bulbs are most wanted, and, provided they are well harvested, will bring the best price; so that in most cases a single line should not be sough. Give nitrate of soda, $\frac{1}{2}$ oz. per square yard.

Potatoes.

Early potatoes should be sprayed with 4-4-40 bordeaux mixture, or a weaker solution, 2-2-40, may be used, provided spraying is taken up as soon as the tops are well above the ground and repeated every twelve or fourteen days. The spray should be regarded entirely as a preventive of disease, which is really all it is. It is very bad policy to leave spraying till disease appears. Difficulty in providing

fresh lime is causing some growers to substitute lime-sulphur for bordeaux. This is not recommended. If a quantity of fresh lime is placed in a barrel, slowly slaked, and then covered with water, it will keep without change for many years. Of course, this wet lime cannot be weighed out, but that does not matter. Use the proper weight of bluestone, add lime from the barrel, and test with ferro-cyanide of potassium. When no acid reaction takes place the mixture is right for use.

SMALL FRUITS.

Raspberries : Superfluous suckers should be suppressed by digging them out if possible, as then they are done with. They soon sprout again if hoed off.

Gooseberries and currants : It is quite common for a number of very strong shoots to break away from near the base of bushes. These if left become a nuisance later on, and they can be easily removed now by breaking them off with a downward push. In the case of black currants some of these growths may be wanted to replace worn branches. Such should, of course, be left alone.

Strawberries should be mulched before the fruit trusses are far advanced. The mulch is then easily applied and the plants grow over it and hold it in place.

Cape gooseberries should be planted at once except where heavy frost is likely to occur.

A GOOD GUERNSEY RECORD.



LEONIE III OF WOLLONGBAR, A MEMBER OF THE WERAROA GUERNSEY HERD.

Completed last month a testing-period of 365 days, with yield of 10,143.25 lb. milk, 579.92 lb. butterfat. Age at commencement of test, 4 years 321 days. One of a purchase of Guernseys from Wollongbar Experimental Farm, New South Wales, in 1916. Sire, Hayes Fido (imp.); dam, Leonie of Wollongbar. The Guernsey herd at the Central Development Farm (Weraroa) now includes eleven females.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

HEIFER WITH BLOOD IN MILK.

“SETTLER,” Mayfield :—

I have not been able to use the milk of a heifer, calved two months ago, because in separating there is always blood left in the separator. Could you tell me the cause of this condition, and would it be advisable to have her come into profit again ?

The Live-stock Division :—

This condition is most frequently brought about by small blood-vessels in the udder rupturing, due to an intense congestion of the udder with blood after parturition. In this case there is no disease in the udder, but owing to the high blood-pressure the ruptured vessels do not readily close, and blood is observed in the milk for some time. In some cows the presence of blood in the milk is noticed only for a few days after calving and passes off without any treatment, in others it is more or less persistent and often resists treatment. Another cause of the trouble is a bruise or contusion of a quarter, due to an external injury. As regards treatment, give the heifer a drench consisting of $\frac{1}{2}$ lb. Epsom salts, $\frac{1}{2}$ lb. ordinary table salt, and 1 oz. ginger, dissolved in a quart of warm water and allowed to cool. In milking, do not strip the udder completely, in order to interfere as little as possible with the injured blood-vessels. Injections into the udder by means of a teat-siphon are not advisable, in view of the danger of setting up a worse condition—namely, mammitis, or inflammation of the udder. If the condition disappears, there is no reason to assume that the trouble will recur after next calving.

CHANGE OF SEED-WHEAT.

W. J. N., Waitahuna :—

Could you tell me if it is good practice to sow repeatedly the same wheat on the one farm without change of seed ? I purchased seed-wheat in 1916, and have sowed it four times now. I have been told by an old farmer that I should get new seed, by doing which I would get better yields. The wheat I have is Solid-straw Tuscan.

The Fields Instruction Branch :—

Wheat grown continuously on the same ground does not naturally deteriorate, and from this point of view there should be no objection to using seed from crops which have been grown on the one farm for a number of years. In practice, however, it often proves advisable to get new seed from time to time. This is not because the seed itself deteriorates, but because impurities have been introduced in various ways, such as by visiting threshing-mills. Impurities of other varieties of wheat are particularly referred to here. The result of the introduction of these varieties is that the seed-wheat is by no means pure after a number of years, and as impure seed will give plants which ripen at different times it is impossible to harvest in such a way as to obtain the best yield. A great proportion of the ordinary farmer-grown wheat is not pure, and it would be an advantage to make an effort to obtain pure seed-wheat—that is to say, a definite variety into which other varieties have not been introduced.

SHELTER-HEDGE FOR CENTRAL OTAGO ORCHARD.

"SHELTER-BELT," Dunedin :—

Can you suggest a suitable tree for a shelter-hedge around an orchard situated in Central Otago (Alexandra)? The orchard is only a small one, so too much space cannot be given for headlands. Some variety that will not rob the soil too much or encroach on the fruit-trees is required. If possible I should like some subject that requires no attention in the way of spraying, pruning, or trimming. The soil is gravelly.

The Horticulture Division :—

You appear to be asking for rather too much; you can hardly expect to obtain adequate shelter without giving some attention to the belt, and any tree must have sustenance. Either the Lombardy poplar or *Cupressus Lawsoniana* will come nearest to your requirements. The poplars may be planted 2 ft. apart, and the only attention required in pruning is to top the trees when they get too high. This is a very popular orchard-shelter in many places. *Cupressus Lawsoniana*, being evergreen and very dense in growth from the ground up, makes a warmer shelter. No trimming would be required for five or six years, after that some cutting-back would be necessary, but not trimming in the ordinary way. It may be planted from 30 in. to 36 in. apart.

W., Auckland :— ERADICATING OXALIS.

I shall be obliged if you can suggest any method of eradicating oxalis.

The Biologist :—

The tuberous root *Oxalis cernua* is no doubt the species you refer to. This is a very troublesome one, particularly in gardens and orchards. In a small area the best way to eradicate it would be to fork it out, taking care to leave no bulbils in the ground. Fowls will eat the bulbils readily. Liming might be tried, as the plant prefers a somewhat sour soil. On a larger area of cultivated land fallowing combined with continuous scarifying, followed by harrowing and burning of the bulbils, &c., should be tried.

A. L. F., Mapiu :— CALF-FOODS.

I would like to know what calf-food is recommended by the Live-stock Division for use with skim-milk. Last season I used crushed linseed with good results, but may be able to do better. Please state quantity per calf.

The Live-stock Division :—

There are a number of good calf-foods on the market, but the Department does not recommend any one in particular. As you state, good results can be obtained in feeding calves with crushed linseed. It has this drawback, however, that it contains too much fat in proportion to its other ingredients, and on this account it requires to be fed sparingly, or to be mixed with some other ingredient such as maize-meal or pollard. Crushed linseed-cake when fed to calves gives better results on the whole than crushed linseed. It should be steeped in boiling water for about twelve hours before being fed. A calf between three and four weeks old should have three to four tablespoonfuls of the paste with each meal, the quantity being gradually increased until two quarts per day is given.

TOP-DRESSING WITH LIME AND SUPERPHOSPHATE.

"NEWCOMERS," Koromatua :—

It appears to be the common practice in this locality when top-dressing with lime and superphosphate to mix the two prior to distribution. It is claimed that as good or better results are attained by this method as when the lime and the super are applied separately. Can you tell us if this practice is recommended, and, if not, the reason for the decision?

The Fields Instruction Branch :—

We can recommend mixing lime and superphosphate just previous to top-dressing pasture, our experience showing that good results have been obtained by this method. The most important matter to consider when top-dressing with this mixture is that the work should not be done until after the winter rains are over. The top-dressing should be carried out as the spring growth is coming on, as super is quick in action and does not require so much rain as is the case with basic slag.

J. K., Raupo :— FEEDING SKIM-MILK TO PIGS.

What is the best way to feed skim-milk to pigs? There seems to be a difference of opinion as to whether it should be fed direct from the separator or allowed to curdle for a day or two.

The Live-stock Division (Instructor in Swine Husbandry) :—

It is not advisable to keep skim-milk for two or three days to allow it to sour and curdle before feeding it to pigs, a certain amount of risk being attached to this practice. Some of the rheumatic complaints are traced to feeding sour milk to pigs, while intestinal disorders occur owing to the great amount of germs which congregate in the receptacles for holding the skim-milk. It is best to feed the milk as follows: Separate in the morning, feed at night; separate at night, and feed in the morning. All barrels, &c., for holding the milk should be kept very clean and scalded out from time to time.

EARWIGS AND FRUIT-TREES.

"ORCHARDIST," Alexandra :—

Would you kindly inform me what steps to take in order to prevent earwigs attacking stone-fruits? They appear to hibernate in the ground, and in the spring ascend the trees, where they do considerable damage.

The Horticulture Division :—

Earwigs are night feeders. They conceal themselves during the daytime among dry rubbish on the ground, in crevices, in hollow trees—anywhere, in fact, where it is dry and dark. Fruit-trees that are properly looked after will afford no day shelter for the insects; they must ascend the trunks from the ground every night. It should be possible to prevent them ascending the trunks by circling them with bands of sacking, the under-part being plastered with a sticky mixture, either fresh coal-tar or a mixture of fat and resin. The soil should be kept cultivated; grass or rubbish of any kind will encourage earwigs.

GROWTH ON HORSE'S FOOT.

H. F. LOUCH, Ngatea :—

Will you kindly advise me as to the treatment for growths on the front foot of a young horse? The growths first made their appearance when the animal was about a year old, and grew to the size of an orange. I cut them off three times with a knife and seared the roots with a hot iron, but this treatment has not altogether cured them, as they still grow to about the size of walnuts.

The Live-stock Division :—

These growths are somewhat difficult to remove, but we would advise you to apply corrosive sublimate and ground lime. Equal parts should be mixed together, and a little applied daily. Before applying the treatment the growth should be thoroughly cleansed by soaking the foot in a solution of disinfectant and water. Care will have to be taken to see that the powder does not spread to the surrounding tissues. A little vaseline or oil should be applied to the affected part in order to prevent this.

ERADICATING WINEBERRY.

"SLASHER," Te Puke :—

Would you kindly inform me as to the best time of the year and the most efficacious method of eradicating the second growth of makomako, known as wineberry?

The Live-stock Division :—

The best method of eradicating this shrub is to cut it during January or February when the weather is hot and dry, and burn it immediately it has dried sufficiently. Makomako does not burn readily, and it should be fired only when the conditions for a clean burn are most favourable. Both sheep and cattle will eat makomako, and if the land is well grassed and stocked after clearing it will probably not give further trouble.

TURNIPS AND RAPE CROP.

"SWEDE," Masterton :—

Will you kindly advise me as to the proper method to employ in sowing turnips and rape together?

The Fields Instruction Branch :—

This mixture is by no means a common one, but it has been successfully used for sheep-feed together with a little mustard. A suitable seeding would be 10 oz. soft turnips, 1½ lb. rape, and 1½ lb. mustard. Sheep will eat the rape and mustard first and leave the turnips till the last. Sowing of the mixture may be carried out from December to the middle of February.

CULTIVATING SWEDES.

"SUPERLATIVE," Ongaonga :—

Can you suggest any method of cultivating swedes when sown in large areas? Would it be a good plan to sow them thick and then tine-harrow them across the drills?

The Fields Instruction Branch :—

Swedes are usually best sown in drills 24 in. to 28 in. apart, and given inter-cultivation by means of the horse-hoe. If sown in 7 in. or 14 in. drills or broadcasted it is good practice to give them one or more strokes (according to thickness of the crop and condition of the land) of the tine harrows. Where possible the harrowing should be done across the drills.

The Cereal Position.—A communication issued by the International Institute of Agriculture in July last on the position of bread cereals (wheat and rye) states that "the outlook for the coming year may be summarized, so far as the present situation indicates, as one which does not justify any serious anxiety, either with respect to the needs of the importers or to the extent of available supplies in the exporting countries."

Conversion of Rock Phosphate into Superphosphate.—Superphosphate is made by treating the phosphate rock with sulphuric acid, the insoluble tricalcic phosphate being converted into soluble monocalcic phosphate, and calcium sulphate also being formed. Full details of the process will be found in standard works on fertilizer-manufacture. One ton of phosphate rock, by the addition of the necessary sulphuric acid, produces nearly 2 tons of superphosphate; the percentage of phosphoric anhydride in the superphosphate is therefore only about half that in the untreated phosphate rock.

REVIEWS AND NOTICES.

"DAIRY-FARMING IN NEW ZEALAND."

THIS is the title of the last of Messrs. Whitcombe and Tombs's half-crown series of "New Zealand Practical Handbooks" to reach us. The author of the little volume of a hundred pages or so, Mr. W. D. Powdrell, M.P. for Patea, is well known as one of the leaders of the dairy industry in Taranaki—one of the capable farmer-business-man type evolved out of the co-operative system of the past twenty years. Writing here from his own experience he has certainly maintained the practical reputation of the series. The book is a good plain statement of leading facts and conditions regarding our dairy industry of to-day, combined with common-sense advice on many points. The treatment is open-minded and non-dogmatic—in fact, one could in certain parts wish that the word "probably" occurred a little less often.

The scope of the work is indicated by chapters on the choice of a dairy farm; buildings; plant and equipment; breeds of dairy cattle; management and improvement of the herd; feeding of dairy cattle; the production and disposal of milk; dairy hygiene; economics of dairy-farming; pigs; and some common diseases of dairy cattle. This last section is by a veterinarian, Mr. A. A. Johnson, and forms a useful feature, while the matter on milk and dairy hygiene is credited in the preface to Mr. L. J. Wild, of Canterbury Agricultural College, although this is not indicated in the body of the work. Among other useful general matter is the text of a share-milking agreement, and the author has a good deal of interest to say about this system, which seems to be steadily increasing as a part in the economic development of the industry with its correlatives of expanding land-values and finance.

As in most of the other volumes of this series that have appeared, the *New Zealand Journal of Agriculture* is paid the compliment of being liberally quoted or referred to. In this case no less than forty-eight articles in the *Journal* are given under the heading of "For Further Reference" at the ends of the several chapters. Acknowledgment is also made of the loan by the Department of Agriculture of blocks of several illustrations and plans. The "well-known Government official" mentioned as the compiler of the figures giving the approximate annual cost of keeping and milking a cow, together with the resultant cost of producing butterfat in New Zealand, is not far to seek in an officer of the Department, whose researches on what may be called the internal economy of the dairy industry are not unknown to *Journal* readers.

A final chapter of "Don'ts for Dairy-farmers" contains some new and cogent points, but one reads with some surprise in a New Zealand work such items as "Don't water your milk and expect the manager to give you a greater test, as there is no fat in water." "Don't water your milk with a view to exchanging the same for your neighbour's whey, because he may not like it; besides, it is dishonest, and often small beginnings lead to big sentences." It may be observed—by the way, and also in lighter vein—that the book if anonymously written would almost betray its Taranaki source. For example, New Zealand is spoken of as a land of splendid roads; boxthorn hedges are given first place for shelter; while the ideal factory described on page 17 may be recognized as that of the co-operative dairy company whose chairmanship the author has so ably held.

A few statements in the book appear to have escaped revision. For instance, in the introductory chapter it is stated that the output of the dairy industry has been nearly doubled in the last half-dozen years. This would apply more correctly to the *value* of the output. A sentence on page 72 from which it might be inferred that the method of killing microbes in milk by heat is illegal also requires straightening-out.

"Dairy-farming in New Zealand" may be commended to *Journal* readers, and will be a useful addition to the farm bookshelf.

CORRESPONDENCE.

ALKALI SOILS AND IRRIGATION.

Mr. S. W. King, of Omanaia, Rawene, writes as follows:—

"On reading the article on 'Mortality among Stone-fruit Trees in Central Otago,' by Mr. G. H. Cunningham, in the *Journal* for June, I think it possible that my experience with irrigation in the Province of Mendoza, Argentina, may be of interest and possibly use to some of your readers. I was for some time manager of the Estancia La California, at Colonia Alvear, which belonged to Mr. John Nelson, of Buenos Aires. In this region, lying just to the east of the Andes, there is no rainfall with the exception of an odd thunderstorm of short duration in the summer, consequently all cultivated areas are entirely dependent on irrigation. La California was 550 hectares in extent (1 hectare = 100 metres square, or nearly 2½ acres), and the whole of this Mr. Nelson was planting in fruit-trees and grapes. Among other trees I planted about 50 hectares with New Zealand apple-trees, and nearly as much with the best varieties of New Zealand peaches. . . .

"Now, although I do not claim to have had any scientific training in the matter of irrigation, I certainly have had a lot of practical experience of it, and that with men who have been at it all their lives and know all that is known about it. From this experience I should say that Mr. Cunningham was quite correct in his finding that excess of water was the main cause of the disease. I should also say that this excess would also bring about the condition in the trees suitable for the attack of the fungus diseases mentioned.

"Irrigation is a very ticklish business and quite an art. It is also a matter that no one can advise on without a thorough local knowledge; but still there are some things you must do and some things you must not do wherever it is practised. For instance, wherever you irrigate you must also *desagua*—that is, you must have deep drains to run off the surplus water and keep the subsoil drained. Also, you should never hold water on the land and allow it all to soak in, but should run it over the land and run it off, allowing what will to soak in. Wherever you have what we called *salitre* in Argentina—probably the same as your alkalis—it is absolutely fatal to allow the water to stand on the land until it all soaks in. I have seen whole vineyards and plantations of peaches destroyed through carelessness in this matter, and the land become quite barren. This generally occurred in low places and hollows, which were looked upon there as very risky places to plant, although to the ordinary man they would look the best. I should say that the orchards in Central Otago, after being well drained, would benefit if irrigation was stopped altogether for, say, one season, or until the trees showed a real want of water. This will, of course, vary, and will depend on the soil, subsoil, rainfall, &c., but established trees with any depth of soil require very little irrigation even in the hottest and driest climates, provided the surface is kept well cultivated."

Importation of Fruit-trees into Australia.—A Commonwealth Proclamation, dated 28th July, 1920, prohibits the importation into Australia of pear, apple, or quince trees, or any portion thereof, which were grown in any country in which pear-blight (fire-blight) (*Bacillus amylovorus*) exists. New Zealand thus comes under the embargo.

Exportation of Live-stock from United States.—New York and Newport News have been appointed under the regulations of the Stock Act as additional ports for the exportation of horses, mules, and asses from the United States of America to New Zealand. Veterinarians in the employ of the United States Government for the ports named will be deemed appointed under the regulations for the inspection of such live-stock prior to shipment to the Dominion.

ANNUAL SHEEP RETURNS, 1920 (30TH APRIL).

TABLE I.—SUMMARY BY SHEEP DISTRICTS.

	Auckland.	Napier-Gisborne.	Wellington-West Coast.	Marlborough-Nelson-Westland.	Canterbury-Kaikoura.	Otago (including Southland).	Total in Dominion.
Stud rams*	649	898	4,332	974	3,773	2,919	13,545
Other rams ..	22,008	75,254	63,630	16,327	65,489	50,330	293,038
Wethers ..	313,209	869,112	1,020,166	225,348	670,956	772,324	3,901,175
Breeding-ewes ..	806,610	2,674,898	2,357,196	714,555	2,858,472	2,156,818	11,568,549
Dry ewes ..	189,054	604,563	450,016	56,719	246,306	275,626	1,822,284
Lambs ..	508,588	1,689,955	1,486,552	316,901	1,163,198	1,150,721	6,315,915
Totals, 1920 ..	1,870,178	5,914,680	5,381,892	1,330,824	5,008,194	4,408,738	23,914,506
Totals, 1919 ..	1,860,698	6,485,286	5,865,960	1,385,870	5,437,961	4,792,779	25,828,554

* Entered in Flock-books.

TABLE II.—COMPARATIVE STATEMENT: TEN YEARS, 1911-20.

Year.	Stud and Flock Rams.	Stud Breeding-ewes.	Stud Dry Ewes.	Stud Lambs.	Total Stud Sheep and Flock Rams.	Flock Sheep, and Sheep of Distinctive Breeds not entered in Flock-books.				Grand Total, Stud and other Sheep.	
						Wethers.	Breeding-ewes.	Dry Ewes.			Lambs.
1911	297,898	229,709	14,117	163,899	705,623	3,342,281	12,094,754	1,298,343	6,555,125	23,996,126	
1912	306,588	232,782	11,563	155,498	706,431	3,359,969	12,044,247	1,324,200	6,515,306	23,750,153	
1913	313,699	228,145	12,902	167,005	722,342	3,207,550	12,292,891	1,150,805	6,818,222	24,191,810	
1914	321,869	229,055	13,526	170,169	734,619	3,211,661	12,661,121	1,152,749	7,008,613	24,708,763	
1915	315,251	237,717	17,341	176,556	746,865	3,270,221	12,377,624	1,365,119	7,141,592	24,901,421	
1916	316,131	252,201	15,012	175,155	758,499	3,478,263	12,640,566	1,189,023	6,721,790	24,788,150	
1917	329,230	160,212	6,212	114,778	610,432	3,457,824	13,099,957	1,066,435	7,035,738	25,270,386	
1918	325,111	171,437	6,297	125,116	627,961	3,696,240	12,850,597	1,592,452	7,770,772	26,538,302	
1919	321,304	165,676	12,196	127,150	626,326	3,922,632	12,176,224	1,799,201	7,304,171	25,828,554	
1920	306,583	154,376	9,733	109,347	580,039	3,901,175	11,414,173	1,812,551	6,206,568	23,914,506	

Notes.—(1.) Stud sheep returned since 1917 are only those entered in Flock-books. (2.) In the 1920 returns the Chatham Islands sheep are included at the figures for 1919, those of this year not being yet available.

TABLE III.—DISTRIBUTION OF THE VARIOUS BREEDS IN EACH SHEEP DISTRICT (1920).

	Auckland.	Napier-Gisborne.	Wellington-West Coast.	Total in North Island.	Marlborough-Nelson-Westland.	Canterbury-Kaikoura.	Otago.	Total in South Island.	Total in Dominion.
Stud sheep (entered in Flock-book)—									
Merino ..	..	..	..	..	4,972	8,476	2,593	16,041	16,041
Lincoln ..	2,463	5,970	22,321	30,754	908	1,587	1,715	4,210	34,964
Romney ..	9,654	11,659	67,654	88,967	7,836	9,708	32,939	50,503	139,470
Border Leicester ..	193	..	535	728	83	10,958	9,944	20,985	21,713
English Leicester ..	471	487	265	1,223	1,389	23,996	869	26,254	27,477
Shropshire ..	155	..	440	595	167	1,750	217	2,134	2,749
Southdown ..	299	2,223	8,103	10,625	128	5,374	161	5,663	16,288
Corriedale ..	..	..	555	555	1	21,848	4,795	26,644	27,199
Other breeds ..	172	1	226	399	37	665	19	721	1,120
Totals ..	13,407	20,340	100,099	133,846	15,521	84,362	53,272	153,155	287,001
Sheep of a distinctive breed but not entered in Flock-book—									
Merino ..	6,721	15,997	16,286	39,004	162,083	361,541	240,961	764,585	803,589
Lincoln ..	14,042	126,437	113,100	253,579	3,901	8,025	8,527	20,453	274,032
Romney ..	228,370	1,100,711	1,046,576	2,375,657	13,207	88,668	405,307	657,182	3,032,839
Border Leicester ..	2,346	2,612	5,218	10,176	393	61,614	69,977	131,084	142,160
English Leicester ..	2,471	296	1,394	4,161	12,789	124,901	8,886	146,276	150,437
Shropshire ..	1,946	73	753	2,760	869	3,604	1,870	6,343	9,112
Southdown ..	534	6,396	19,600	26,530	109	5,339	437	5,885	32,415
Corriedale ..	43	102	7,735	7,940	1,877	254,811	176,408	433,096	441,936
Halfbreeds ..	..	..	..	..	151,295	740,656	250,508	1,142,459	1,142,459
Other breeds ..	557	245	1,078	1,880	1,171	11,179	163	12,513	14,393
Totals ..	257,030	1,252,926	1,211,740	2,721,696	497,694	1,660,338	1,162,744	3,320,776	6,042,472
Crossbreeds and others not otherwise enumerated	1,599,741	4,641,414	4,070,053	10,311,208	817,609	3,263,494	3,192,722	7,273,825	17,585,033
Grand totals ..	1,870,178	5,914,680	5,381,892	13,166,750	1,330,824	5,008,194	4,408,738	10,747,756	23,914,506

THE BEET-SUGAR INDUSTRY.

VICTORIAN EXPERIENCE AT MAFFRA.

[The article which follows is by Mr. W. L. WILLIAMS, manager of the beet-sugar factory at Maffra, operated by the Government of Victoria. The matter was published recently in the *Journal of the Department of Agriculture* of that State, and has since been issued in pamphlet form. It is now reprinted in these pages for general information, Victorian conditions being perhaps nearest generally to those of New Zealand in regard to this branch of agricultural industry. With the recent enormous appreciation in the market value of sugar the long-standing proposals to establish the beet-sugar industry in New Zealand have entered on a new phase, and it is hoped shortly to deal with the subject in the *Journal* more directly in relation to our own conditions. The results of assays of sugar-beets grown last season in various parts of the Dominion will be available for publication in next month's issue.—EDITOR.]

WHY THE INDUSTRY SHOULD BE DEVELOPED.

THE world's beet-sugar industry was launched in the beginning of the nineteenth century, and has made such rapid and sound progress since then that just prior to the Great War it was responsible, under white labour, for approximately half the world's production of sugar, and for a remarkable increase in the production of cereals and in the rearing of stock wherever the industry was established. Its greatest stronghold has been, and still is, in Europe.

It was introduced to America with some trepidation, because of the competition that had to be met from the many adjacent cheap-labour cane-sugar areas, and of the necessity for meeting higher costs of material, and the employment of a more independent and costly class of labour. In spite of these difficulties the industry has developed there to such an extent that it now produces about 75 per cent. of the sugar grown in the United States, and its economic and decentralizing value has become so evident that the Government is energetically using every reasonable means to encourage its expansion.

Its value to America, where labour and other conditions are very similar to our own, is probably the best index of what it might become to the temperate zones of Australia if rightly encouraged and developed. There has been some question as to whether Australia might not produce too much sugar should further factories be established, but such a view makes no allowance for the progress we have every reason to expect. To allay any fears, it may be of interest to mention that recently much anxiety was expressed as to how a surplus of cane-sugar produced in 1917-18 in Queensland might be disposed of, and factory extension was promptly discouraged; yet inside of twelve months the expected surplus had resolved itself into a shortage, and we are now actually importing sugar, and are likely to do so for some years to come.

For national strength and safety, and in justice to the cramped European races requiring more favourable living-conditions and better opportunities, it appears to be a duty as well as a privilege to rapidly expand our population, and thereby increase our production and consumption of foodstuffs, of which sugar is such a necessary and increasingly important item. Our preserved fruits, condensed milk, and confections are winning increased favour and demand at home and abroad, and these will absorb largely increasing quantities of sugar. Furthermore, the world to-day is short of sugar to the extent of 3,000,000 tons a year, with a growing demand, equal to about 10 per cent. per annum, as people are coming to realize that sugar, once a costly luxury, is now undoubtedly a cheap and most effective energy-producing food.

Most of all, the economic advantages due to the encouragement of such country industries as the beet-sugar business, which rapidly intensifies all other production and adds to the wealth and comfort of producer, labourer, and consumer, must attract the thought and attention of those who desire to develop our great resources to the best advantage.

For these reasons the beet-sugar industry, with its favourable white-labour conditions, is likely to hold a strong position in the production of what we might rightly term a staple food-product, and in the promotion of closer settlement and intense farming.

A BRIEF ACCOUNT OF SUGAR-BEET GROWING IN VICTORIA.

It will not be out of place to touch very lightly on the genesis of the beet-sugar industry in Victoria. Its difficulties and discouragements may act as danger-signals against faulty methods, while the advantages observed may help to pilot any extension of this valuable industry along safe and successful lines.

From 1866 until 1898 the industry in Victoria was toyed with in a perfunctory way without any success from a manufacturing point of view, though some sugar was actually manufactured at the Anakies Mill in 1873. Some very useful and promising experiments were carried out in the growing of sugar-beet, chiefly in Gippsland and the Western District, indicating that our climatic and soil conditions are reasonably favourable. Very successful plots, both as regards tonnage and sugar-content, were grown in the Port Fairy, Narre Warren, and Maffra districts, and more recent experiments tend to confirm the opinion that Victorian conditions are generally favourable to the growing of beet.

The districts with a suitable rainfall, however, at present offer the most favourable field for the extension of the industry, though, taking into consideration the question of sugar-content, surety of yields, and convenience of handling the beets in the drier areas under irrigation, irrigable areas may eventually prove most desirable. At one time it was thought that irrigation would be detrimental to sugar-content, but in actual experience it is found that an abundance of moisture applied in the early-growing period, with comparatively dry and sunshiny conditions towards maturity, is more conducive to high purity, good sugar-content, and regular yields than those uncertain, irregular climatic conditions which so often result in a dry growing-period, with excessive rains at maturity, thereby producing low-grade beets. Victoria has not yet had occasion or opportunity to broadly determine which is the more favourable; but, as in America, it is likely that both irrigable and good rainfall areas will produce profitable beets, the irrigated areas being more costly but more reliable than the non-irrigated.

The fact that numerous but small test-plots right back in 1887-90 indicated favourable possibilities for beet-sugar growing was not sufficient to prove that the industry under ordinary business conditions, where all manner of contingencies and difficulties have to be met and allowed for, could become a financial and commercial success; and in 1898 the industry was put to a definite and what was expected to be a fairly complete test.

After some years of organizing, a company was formed, and a substantial and well-equipped factory was constructed at Maffra, said to be capable of treating 400 tons of beets per day. A considerable area of beet was planted in the spring of 1897, but a dry summer was experienced. In the autumn of 1898 the factory treated some 9,000 tons of beets, yielding 504 tons of white granulated sugar, as well as a quantity of raw sugar and molasses. The sugar found a ready market, but the season ended with a heavy loss, and growers generally seem not to have secured profitable yields at the low rates then prevailing for beets. The factory operated for a second season, and treated the product of 1,500 acres, or some 6,000 tons of beets, for 307 tons of sugar. Neither field nor factory results were satisfactory, and the accumulated losses of the two seasons were such as to compel the company to suspend operations, while the growers were far from successful with their crops. At the same time there were definite indications that a well-managed factory operating to capacity should produce a high grade of sugar, and run profitably; and in the field some of the crops proved that profitable yields of high-grade beets could be grown under right conditions.

The failure seems chiefly to have been due to insufficient rainfall, accentuated by inexperience and faulty cultivation, and inefficient business and technical control in the factory, resulting in costly running and a low extraction of sugar. Excepting the climatic influences, the other reasons for difficulties during the initial stages of this new industry were to be expected, and a longer experience should gradually have eliminated them. The adverse influence of a light and erratic rainfall could certainly have been modified by better methods of

cultivation, but climatic conditions were undoubtedly responsible in the main for failure. At this stage the plant and buildings had cost the company, approximately, £75,000; and, as the Government had advanced the company £63,000, it took possession, and retained the mill inactive, but in good order, for a term of ten years, during which time a number of experimental beet crops were grown in the district. Owing to a revival of interest by the Government and district farmers, Dr. Walter Maxwell was, in 1909, invited to report on the industry and its possibilities. He recommended that the factory be reopened as an experimental concern, and be supported by the Government until such time as beet-growing should develop sufficiently to enable the mill to be placed on a commercial and profitable basis. An American manager was appointed, and the mill reopened in 1910, under the control of the Department of Agriculture, with the following results:—

1910-11.—458 acres were harvested for 5,970 tons of clean beet, producing 482 tons of sugar, and a quantity of molasses and beet-pulp very suitable for stock-feed. The rainfall was exceptionally good, and the price paid for beets was 16s. per ton. With the heavy expense of reopening, and the small turnover, the factory was naturally run at a loss.

1911-12.—752 acres were harvested for 3,975 tons of beet, producing 519 tons of sugar. The Boisdale Closer Settlement Estate became associated with the industry by agreement that each block should provide 10 acres of sugar-beet per annum. Owing to the unavoidable late preparation, and a dry-growing period, the crops were disappointing, and the factory was operated at a loss. The price paid for beets was £1 per ton, plus a bonus of 5s. 4d. granted to offset the low yields, and because of the high sugar-content of the beets.

1912-13.—900 acres were harvested for 6,208 tons of beet, producing 648 tons of sugar. The season was dry until harvest-time, and rain came at a period when it reduced the sugar-content without materially increasing the tonnage. The price paid for beets was £1 per ton. On 31st December, 1912, the assets were taken at an operating valuation, and a first balance-sheet was prepared for the six months ending 30th June, 1913, as follows: Liabilities at 30th June, 1913, £86,276 14s. 11d. Assets—Land, plant, equipment, &c., £64,647 2s. 5d.; debtors, &c., £4,377 5s. 10d.; stocks, £13,673 6s. 2d.; loss, half-year, after charging interest and depreciation, £3,579 0s. 6d.; total, £86,276 14s. 11d.

1913-14.—1,000 acres were harvested for 7,432 tons of beet, producing 920 tons of sugar. The price of beets was 23s. per ton. Another dry period was experienced, and the compulsory growing of beet on both the Boisdale and Kilmany Closer Settlement Estates was discarded, as they were found unreliable without irrigation. Beet-growing by the factory was also discontinued. Where irrigation was tried the results proved most satisfactory, but the settlers did not then show sufficient interest to encourage the Government to proceed with an irrigation scheme. Liabilities at 30th June, 1914, £100,906 17s. 7d. Assets—Land, plant, equipment, &c., £63,927 6s. 7d.; debtors, &c., £3,309 15s. 5d.; stocks, £19,786; profit and loss account, £3,579 0s. 6d.; loss for year after interest and depreciation, £10,304 15s. 1d.; total, £100,906 17s. 7d.

1914-15.—990 acres were harvested for 8,843 tons of beet, producing 1,182 tons of sugar. The price of beets was 23s. per ton. Although a dry year, a very favourable fall of rain during the growing season occasioned a satisfactory crop, but it was estimated that 1,500 tons of beets were diverted for stock-feeding purposes. Liabilities at 30th June, 1915, £107,657 5s. 9d. Assets—Land, plant, equipment, &c., £61,678 0s. 9d.; debtors, &c., £3,927 8s. 10d.; stocks, £25,382 10s.; profit and loss account, £13,883 15s. 7d.; loss for year, after interest and depreciation, £2,785 10s. 7d.; total, £107,657 5s. 9d.

1915-16.—461 acres were harvested for 4,928 tons of beet, producing 560 tons of sugar. Owing to local difficulties, and the uncertainty of seed-supplies coming to hand under war conditions, only a small acreage was planted, but the financial result was comparatively good. The price paid for beets was 25s. per ton. Liabilities at 30th June, 1916, £96,663 8s. 9d. Assets—Land, plant, equipment, &c., £57,007 10s. 10d.; debtors, &c., £2,842 13s. 5d.; stocks, £16,955; profit and loss account, £16,669 6s. 2d.; loss for year, after interest and depreciation, £3,188 18s. 4d.; total, £96,663 8s. 9d.

1916-17.—1,320 acres were harvested for 15,159 tons of beet, producing 1,948 tons of sugar. The price of beets was 27s. 6d. per ton. Floods destroyed some 300 acres of the area planted, otherwise the season was good, and the factory was enabled to run to much better advantage on the improved tonnage, showing a profit of £8,013 13s. 2d. Liabilities at 30th June, 1917, £121,159

os. 1d. Assets—Land, plant, equipment, &c., £57,179 16s. 4d.; debtors, &c., £1,615 12s. 5d.; stocks, £50,519; profit and loss account, £19,858 4s. 6d.; profit for year, after interest and depreciation, £8,013 13s. 2d.; total, £121,159 os. 1d.

1917-18.—1,200 acres were harvested for 14,487 tons of beet, producing 1,650 tons of sugar. The price of beets was 27s. 6d. per ton, and the yield satisfactory. The sugar-content, owing to climatic conditions and somewhat doubtful seed, was low, thereby modifying the production of sugar and the profits. Liabilities at 30th June, 1918, £109,139 2s. Assets—Land, plant, equipment, &c., £54,968 11s. 6d.; debtors, &c., £2,138 10s. 8d.; stocks, £42,055; profit and loss account, £11,844 11s. 4d.; profit for year, after interest and depreciation, £1,867 11s. 6d.; total, £109,139 2s.

1918-19.—1,009 acres were harvested for 12,289 tons of beet, producing 1,263 tons of sugar. The price of beets was 27s. 6d. per ton. Although the tonnage was satisfactory, a dry spring and summer, followed by a wet autumn, was responsible for an abnormally low sugar-content, which very adversely influenced the sugar-yield and financial results. Liabilities at 30th June, 1919, £104,188 19s. 11d. Assets—Land, plant, equipment, &c., £52,909 12s. 8d.; debtors, &c., £4,101 17s. 2d.; stocks, £35,418 13s. 6d.; profit and loss account, £9,976 19s. 10d.; loss for year, after interest and depreciation, £1,781 16s. 9d.; total, £104,188 19s. 11d.

Analysis of Profit and Loss Accounts.

Year.	Capital.	Receipts, including Increase or Decrease in Stock.	Expenditure.	Profit.	Loss.
	£	£	£	£	£
1912-13 (6 months) ..	76,416	14,557	18,136	..	3,579
1913-14 ..	79,432	22,630	32,935	..	10,305
1914-15 ..	79,520	28,766	31,552	..	2,786
1915-16 ..	78,682	22,406	25,595	..	3,189
1916-17 ..	81,391	54,510	46,496	8,014	..
1917-18 ..	81,708	53,346	51,478	1,868	..
1918-19 ..	82,068	41,361	43,142	..	1,781
		237,576	249,334	9,882	21,640
Deduct profit ..		..	..	..	9,882
Net loss to 30th June, 1919 (after charging interest and depreciation amounting to £39,210)					11,758

Details of Expenditure.

Year.	Salaries and Wages.	Purchase of Beet.	Materials, &c.	Other.	Deprecia- tion.	Interest, 4 per Cent. on Capital.	Total.
	£	£	£	£	£	£	£
1912 - 13 (6 months) ..	4,098	4,345	3,682	3,085*	1,430	1,496	18,136
1913-14 ..	6,562	8,532	4,568	6,681†	3,536	3,056	32,935
1914-15 ..	7,644	10,170	4,883	2,662	3,010	3,177	31,552
1915-16 ..	5,688	6,064	4,008	3,500	3,154	3,181	25,595
1916-17 ..	8,147	20,286	8,437	3,942	2,537	3,147	46,496
1917-18 ..	9,227	19,403	13,200	3,794	2,528	3,266	51,478
1918-19 ..	8,582	16,319	7,929	4,626	2,418	3,268	43,142
	49,948	85,179	46,707	28,290	18,619	20,591	249,334

* Loss on cultivation, £690.
survey, £300.

† Loss on cultivation, £2,736; duty and charges, £1,804; contour

In the above period of six years and a half, from 1,000 acres per annum the Government has been fully reimbursed all costs and expenses, has received £20,591 interest, as well as £6,861 cash towards the depreciation reserve, instead of £18,619 charged.

Maffra Sugar-factory Manufacturing Results.

—	1911.	1912.	1913.	1914.	1915.	1916.	1917.	1918.	1919.
Acres harvested ..	458	752	900	1,000	990	461	1,320	1,200	1,009
Beets worked (tons) ..	5,970	3,975	6,208	7,432	8,843	4,928	15,159	14,487	12,289
Percentage sugar in cossettes	13.9	19.2	14.5	17.1	17.2	15.45	15.85	14.45	13.49
Percentage purity ..	85.0	87.8	83.0	85.6	84.7	85.7	85.9	80.5	82.0
Sugar produced (tons) ..	482	519	648	920	1,182	500	1,948	1,650	1,263
Percentage extraction ..	8.06	13.06	10.44	12.39	13.36	11.37	12.85	11.39	10.28
Molasses produced (tons)	..	266	362	435	468	251	480	344	460

Maffra Factory Rainfall Records.

—	April to September.	October to March.	—	April to September.	October to March.
	Inches.	Inches.		Inches.	Inches.
1910-11 ..	8.96	19.64	1915-16 ..	7.65	12.61
1911-12 ..	9.71	6.97	1916-17 ..	11.91	11.82
1912-13 ..	9.19	12.19	1917-18 ..	9.36	15.45
1913-14 ..	9.34	8.88	1918-19 ..	13.37	9.47
1914-15 ..	6.96	7.62	1919-20 ..	11.91	..

OUTLINE OF BEET-SUGAR MANUFACTURING PROCESS.

The weighed beets are sampled, and a percentage determined and deducted for dirt and improper topping. They are dumped from tip-drays, or unloaded from trucks into V-shaped bins. Water-flumes underneath these bins convey the beets to a large beet-wheel, which lifts them into a mechanical washer, where, by agitation and a large supply of water, the adhering dirt is removed. The beets are then carried over to a bucket elevator, which drops them into a beet-slicing machine, where they are cut into fine grooved shreds or cossettes. These cossettes are conveyed to a diffusion battery of fourteen cells, where, by the circulation of hot water, the sugar is diffused from the slices in the form of a sweet juice, and the exhausted cossettes remain as an ideal stock-food, termed "beet-pulp."

Good average beets should test 15½ per cent. of sugar, at a purity of 85 per cent., and yield 12½ per cent. of refined white sugar, the balance remaining partly in the final molasses, while a percentage is lost in process.

The diffusion juice is heated and run into carbonatation-tanks, where it is treated with lime-milk and carbon-dioxide gas drawn from the lime-kiln. This is the chief refining process, the impurities being largely decomposed and precipitated, and the juice sterilized.

The lime with the impurities is removed by forcing the juice through frame filter presses lined with double layers of cotton duck. The juice is given a second carbonatation and filtering, and is then run to the sulphur-tanks, where it is treated with sulphurous acid, and well heated to further purify and clarify it. Following another filtration, the thin refined juice is taken to the quadruple-effect evaporators, where the excess moisture is removed by boiling under the influence of a vacuum. The concentrated juice is filtered and taken to a large vacuum-pan, where it is boiled to a mass of sugar grain and molasses, termed "melada." This melada is run into high-speed centrifugal machines, whereby the molasses is separated from the sugar-crystals, which are washed, dried in a granulator, and bagged ready for consumption. Eight tons of good-quality beets effectively treated should produce 1 ton of white granulated sugar.

The first molasses is reboiled for a second-grade sugar and molasses, and this sugar is mixed with the fresh juices and further refined to white sugar. The second molasses is either reboiled for a third sugar, or, if final, is sold as stock-food molasses, or used for the manufacture of methylated spirit.

The Maffra factory cuts about 200 tons of beet a day, but with increasing costs of material, labour, &c., it would naturally run to much greater advantage

if remodelled on a 500-ton basis. Large quantities of coal, bags, filtering-material, lime-rock, and manufacturing supplies are used. About 140 men are required for factory operations. All mechanical repairs are effected on the spot, as the plant has to run continuously day and night for three or four months. The technical results are carefully watched, and manufacturing results regulated throughout by comprehensive chemical analyses.

A live sugar-factory stimulates a country district to a remarkable degree, and is a great acquisition, attraction, and advantage to all parties, particularly to the farmers' sons, as it disturbs the ordinary monotony of farm life and offers them interesting employment.

Wholesale sugar-prices since the reopening of the factory have been approximately as follows: 1910, £22 12s. 6d.; 1911, £22 12s. 6d.; 1912, £22 12s. 6d.; 1913, £22 2s. 6d.; 1914, £21 2s. 6d.; 1915, £25 12s. 6d.; 1916, £29 7s. 6d.; 1917, £29 7s. 6d.; 1918, £29 7s. 6d.; 1919, £29 7s. 6d.

BY-PRODUCTS OF THE BEET-SUGAR INDUSTRY.

These are important, and are of particular value to any district interested in stock-raising and dairying.

Beet-tops.

Commencing in the field, the beet crowns and tops may be siloed or fed green or dry, and they are generally considered worth the rental value of the beet land. They are *ideal* for fattening stock.

A thrifty, far-seeing farmer would probably elect to plough them in, thereby restoring valuable mineral matter and humus to the soil. In this way the fertility of the soil may be well maintained, as by far the greater part of the plant-food is to be found in the crown and leaves.

A 20-ton crop of clean beets per acre contains plant-food as follows: In topped beets—Potash, 152 lb.; nitrogen, 60 lb.; phosphoric acid, 36 lb.; soda, 24 lb.; lime, 16 lb. In crown and leaves—Potash, 235 lb.; nitrogen, 113 lb.; phosphoric acid, 80 lb.; soda, 199 lb.; lime, 208 lb.

It is evident that it must pay to plough in the tops, though to feed them off in the field with sheep and so return these plant-foods in the form of manure has been found more profitable and good policy, providing the stock are withdrawn during wet weather.

Beet-pulp.

Beet-pulp consists of the beet-slices exhausted of their sugar, and is a most valuable by-product. It represents about 85 per cent. of the beet, but loses a lot of weight when stored. It may be used immediately, or run into large open silos for use throughout the year. Dairymen use it very freely, as it has been found to stimulate milk-production to a marked degree. It is evidently far more valuable as stock-feed than its analysis indicates, being very succulent and exercising a stimulating and wholesome effect upon the digestive organs.

It should be fed with lucerne, other hay, or chaff to secure the best results and a well-balanced ration. Dairymen feed pulp at the rate of about 56 lb. per day per cow, and it has not merely saved stock, but has kept many herds in profit-making condition during drought periods in the Maffra district. It is sold at from 2s. 6d. to 5s. per ton.

The siloed pulp rapidly ferments or matures, and in such state is found to be a more valuable stock-food, though rather unpleasant to handle.

So long as a factory has capacity and demand enough to hold its beet-pulp in a wet state it is probably wise and economical to do so, for the cost of drying is very heavy and only worth consideration when the quantity is very large and the local demand limited. The cost in fuel and plant to reduce the pulp from 89 per cent. of moisture to 10 per cent. is so high that it should only be considered for such surplus pulp as is not required for local use. Where large quantities are available the convenience in storage and distribution of dried pulp is undoubtedly attractive, and in America it has a wide distribution and a ready sale at high prices.

In Maffra the demand for wet pulp for use during the dry months is now far ahead of the supply, and it is a valuable support to the dairying industry.

Molasses.

Molasses is an important by-product containing 48 to 50 per cent. of sugar not readily crystallizable. Although not so pleasant to the taste as cane molasses, its feeding-value is good, and it is largely used for stock-feeding

purposes with great advantage. Quantities are also used by distillers for the manufacture of methylated spirit.

Where the quantity of molasses is large enough to warrant a heavy outlay on plant it may be treated by the "Steffen's" process for the extraction of the greater part of its sugar, and the residue is then frequently evaporated for its potash, now so valuable.

Lime-scum.

Lime-scum is the waste lime remaining after the refinement of the beet-juices, and in process it has absorbed an amount of organic and other useful fertilizing-matter. After it has dried out sufficiently to handle it may be spread with great advantage on heavy and sour lands, improving the physical condition of the soil, correcting acidity, and making more readily available the mineral plant-foods in the soil.

Many farmers seem not yet as interested as they should be in the value of lime, particularly for the maintenance or restoration of the fertility of their continuously cropped areas. Where a sugar-mill is rightly located the lime-scums may be run off with the large quantities of waste water and used for irrigation purposes. Spreckles' large sugar-mill in California distributes the waste water and lime in this way over miles of country, and it has a very favourable influence on the heavy adobe soils.

Sundries.

Waste ashes and cotton filter-cloths find much useful service, and a beet-sugar factory economically run and rightly appreciated may turn its products and by-products to full advantage, the by-products in particular being a great support to stock and dairy farming.

*** SUGAR-BEET GROWING.**

Successful beet-growing calls for good soil, intense culture, and suitable climatic conditions. No firm rules can be prepared to meet the varying conditions under which beet may be grown, and every farm and every season has its peculiarities, demanding keen individual attention and frequently modified methods.

Climate.

While the wild beet finds its home on the sea-coast areas of tropical climates the improved sugar-beet gives the most satisfactory results in temperate climates.

Soil.

Although beets are grown on a variety of soils, it is advisable here to select the best land with a view of securing good yields that will more easily bear the high costs of production. When the industry is thoroughly established beets may be grown on poorer lands for the indirect advantage of improving such soils for other crops. The intense culture and deep-rooting habits associated with beet-growing will undoubtedly, as in Europe, have a valuable influence on the fertility and production of our second-rate soils.

Rich sandy or silty loams and heavy loams with a good depth of soil and comparatively free subsoils are desirable. A good-type beet must root deep, so that waterlogged areas and soils with an impervious hard-pan near the surface are unsuitable unless such faults are corrected. Raw peat lands are not desirable. Sandy heath lands often produce impoverished or stunted beets high in sugar-content.

Cultivation.

Where convenient, the beet-land should be deep-ploughed, or ploughed and subsoiled, in the autumn up to 12 in., and allowed to mellow during the winter. In the early spring the area should be surface-cultivated or shallow-ploughed and brought to a fine tilth, with a well-firmed soil and a fine seed-bed. Good preliminary cultivation is a long step towards success and economy in growing the beet crop.

Seeding and Fertilizing.

Seeding should immediately follow the final cultivation of the seed-bed, in order that the weeds may have no advantage over the beet-seed.

If the soil is dry, free, and warm, sow on a rolled surface; if moist and disposed to cake, plant on a harrowed surface about $\frac{1}{2}$ in. deep for early sowings,

and deeper for the late sowings. Sometimes growers plant the seed very deep in loose soil, and generally secure a slow, thin, unsatisfactory germination. A special four-row beet-seed drill is used, with rows 18 in. or 20 in. apart, the most favoured widths for yield of sugar per acre. About 12 lb. of seed is sown per acre, because it is necessary to secure a rapid, strong germination, the germinating seeds helping one another through. The Maffra district is generally warm and fairly early, so that some plantings may be made, if the weather conditions are favourable, as early as July, but very early plantings are liable to run somewhat to seed, with a consequent loss in sugar-content. August plantings are considered early, September normal, and October-November plantings late.

Superphosphate is drilled in beforehand or with the seed, and has consistently proved beneficial to the growth of the plant without disturbing the sugar-content and purity of the beets. The quantities used locally range from $\frac{1}{2}$ to 2 cwt. per acre.

The well-farmed soils in this district seem to have plenty of nitrogen available, and it is no advantage to unduly force the growth of leaves to the detriment of the roots. The beet uses up a quantity of potash, which seems to be sufficiently plentiful in this district, but would probably have to be added in the form of sulphate of potash in most well-established beet areas. By ploughing-in the beet crowns and tops a great part of the plant-food absorbed by the beets may be restored to the soil. Beets thrive in well-limed soils, but growers have not yet seen fit to use the mill-waste lime as freely as they should.

Tillage.

Early plantings should germinate in a fortnight, late plantings in a week, and directly the rows are defined the area should be rolled and followed by four-row beet-cultivators fitted with special sweeps that will cut very close to the rows without disturbing the beets. This first cultivation can hardly be done too early, and is most important in checking the weeds, giving the beets a strong, clear start, and making the thinning-conditions easy and economical. The growers who neglect or delay their first cultivation almost invariably pay dearly for it subsequently. The intertillage is not costly, as a four-row machine will comfortably do 10 acres a day, and should be applied after thinning and after rain as frequently as necessary to keep the soil in the best condition and free of weeds.

Thinning and Side-hoeing.

Beet-thinning is the principal hand-work, and is done by casual labour on contract. As a rule it is best for the grower to devote his own time to the cultivation work, and have the thinning done quickly by contract labour at the ruling rates.

Thinning should be done soon after the first cultivation, and commenced while the beets are quite small, as young beets are easier to thin than forward beets, and such thinning is more satisfactory for the contractor. Furthermore, if delayed, the weeds soon develop, and the beets get overstrong and are difficult to handle, thereby adding to the cost of thinning. The absorption of moisture by a full stand of beets allowed to remain too long unthinned is a heavy pull on the soil, and will invariably reduce the yield of beets to a tonnage considerably below those sections thinned at the correct period. Experience and costs have repeatedly shown that it is better to err on the early side than on the late side when thinning beets.

Thinning is done with short-handled hoes to space the beets. The left hand of the operator is free to thin the beets to a single strong plant at distances approximately 8 in. in very rich, moist soils, 10 in. in good beet-soil, and 12 in. in medium or drier soils. Many thinners become very expert at the work, and do as much as half an acre and sometimes more per day.

The development of single-germ seeds would be a great advantage to thinning, and check-row planting a possible improvement.

Side-hoeing is done with long-handled hoes a few weeks after thinning to remove all weeds growing in the rows, the cultivator destroying everything between rows. Side-hoeing is frequently done by contract, at prices varying according to the cleanness or otherwise of the crop. Beet-thinning and side-hoeing are in process in the Maffra district from August to December.

(To be continued.)

STOCK SLAUGHTERED, 1919-20.

THE following are the numbers of stock slaughtered at abattoirs, meat-export works, bacon-factories, and ordinary slaughterhouses throughout the Dominion during the year ended 31st March, 1920 :—

—	Abattoirs.	Meat-export Works.	Bacon-factories.	Ordinary Slaughterhouses.	Totals.
Cattle ..	102,714	256,459	..	54,033	413,206
Calves ..	22,692	9,377	..	2,302	34,371
Sheep ..	604,708	4,658,897	..	248,877	5,512,482
Lambs ..	114,946	3,139,238	..	26,417	3,280,601
Swine ..	53,886	38,043	23,296	25,520	140,745

In addition to the above, 24,424 pigs killed and dressed by farmers were inspected at butchers' shops.

LAND FOR RETURNED SOLDIERS.

THE lands at present notified to be opened in the various districts in October are : Auckland—Matamata North Block, of 360 acres, subdivided into five sections ; Hawke's Bay—Paremata Settlement, of 998 acres, subdivided into six sections ; Southland—Strathvale Settlement, of 838 acres, subdivided into nine holdings. It is also anticipated that several other estates purchased for closer settlement will be thrown open for selection in October, or early in November, the principal blocks being situated in the Canterbury District. The main features of the lands to be opened for selection during the current September were published in last month's *Journal*.

FORTHCOMING AGRICULTURAL SHOWS.

Hawke's Bay A. and P. Society : Napier, 20th and 21st October, 1920.
 Marlborough A. and P. Association : Blenheim, 26th and 27th October, 1920.
 Poverty Bay A. and P. Association : Gisborne, 26th and 27th October, 1920.
 Wairarapa and East Coast A. and P. Society : Carterton, 27th and 28th October, 1920.
 Canterbury A. and P. Association : Christchurch, 11th and 12th November, 1920.
 Manawatu and West Coast A. and P. Association : Palmerston North, 3rd, 4th, and 5th November, 1920.
 Wanganui Agricultural Association : Wanganui, 17th and 18th November, 1920.
 Banks Peninsula A. and P. Association : Little River, 23rd November, 1920.
 Thames Valley A., P., and H. Association : Te Aroha, 24th and 25th November, 1920.
 Auckland A. and P. Association : Auckland, 3rd and 4th December, 1920.
 Southland A. and P. Association : Invercargill, 14th and 15th December, 1920.
 Woodville A. and P. Association : Woodville, 25th and 26th January, 1921.
 Feilding I., A., and P. Association : Feilding, 1st and 2nd February, 1921.
 Clevedon A. and P. Association : Clevedon, 5th February, 1921.
 Otago A. and P. Society : Dunedin, 9th and 10th February, 1921.
 Northern Wairoa A. and P. Association : Aratapu, 19th February, 1921.
 Franklin A. and P. Society : Pukekohe, 25th and 26th February, 1921.
 Morrinsville A., P., and H. Society : Morrinsville, 9th March, 1921.
 Temuka and Geraldine A. and P. Association : Temuka, 7th April, 1921.

(A. and P. Association secretaries are invited to supply dates and location of their shows.)



The New Zealand Journal of Agriculture.

VOL. XXI.—No. 4.

WELLINGTON, 20TH OCTOBER, 1920.

POWDERY SCAB IN POTATOES.

THE AUSTRALIAN EMBARGO.

A. H. COCKAYNE, Biologist to the Department.

IN November, 1919, several small consignments of potatoes, totalling some four hundred sacks, were shipped from the Dominion to Melbourne. On arrival at that port they were found to be infected with powdery scab (*Spongospora subterranea* (Wall.) John.), and were promptly condemned by the Australian quarantine authorities. In consequence of these shipments the Commonwealth Government immediately placed a total embargo on the importation of New Zealand potatoes into any part of Australia except in quantities of not more than 14 lb. This action completely stopped a trade that had been carried on for many years past during seasons when a remunerative price was obtaining in Australia.

This year the high prices for potatoes in Australia, coupled with the overproduction and consequent low prices in New Zealand, made it extremely desirable that the embargo should be lifted. The Australian authorities, however, notwithstanding the repeated and earnest representations of the New Zealand Government, remained firm in their determination to exclude any importation of New Zealand potatoes. Finally a delegation, of which the writer was a member, was sent to

Australia in order to put the position fairly before the Commonwealth Government. It was then finally agreed to send an expert to New Zealand to determine whether or not New Zealand potatoes could be imported into Australia without any danger of the disease being introduced there. This agreement was arrived at mainly through the delegation's contentions that there were in New Zealand localized potato-growing areas where the disease had not been found, and that, at any rate, even where the disease was prevalent it had little, if any, significance on the production of potatoes.

The expert nominated by the Australian authorities is at time of writing making an extensive investigation of the main potato-growing districts of New Zealand, collecting all possible data, so as to determine whether or not the contentions of the delegates were correct, and to ascertain whether methods of shipment can be devised whereby, if exportation is resumed, any possible danger of the introduction of powdery scab from New Zealand into Australia can be eliminated. The collection of these data must naturally take some time, and the final decision of the Commonwealth authorities will apparently not be made until the fullest consideration has been given to all phases of the investigation. It is therefore obvious that prospects for the shipment of any of the present stored crop, even from the limited areas that are departmentally considered free from the disease, are very doubtful, especially as it is currently reported that there are sufficient Australian potatoes for the Commonwealth requirements.

It will be well to here detail the main reasons that have been advanced by the Australian authorities in their contention that it is necessary to exclude the importation of New Zealand potatoes. They may be summarized somewhat as follows: (1.) Powdery scab is admittedly prevalent over certain of the main potato areas in New Zealand. (2.) The disease is not present in Australia at the present time. (3.) Many plant pathologists have declared that powdery scab is a dangerous disease. (4.) The fact that powdery scab is comparatively harmless in New Zealand is no criterion that if introduced into Australia it might not become a limiting factor in potato-production. (5.) The total prohibition of importation of potatoes from an infected country is the only satisfactory method of avoiding introduction into Australia of powdery scab. (6.) In order to build up an export trade in potatoes between Australia and the United States, Australia must not only be free of powdery scab, but must have an adequate quarantine against any country where the disease is known to exist.

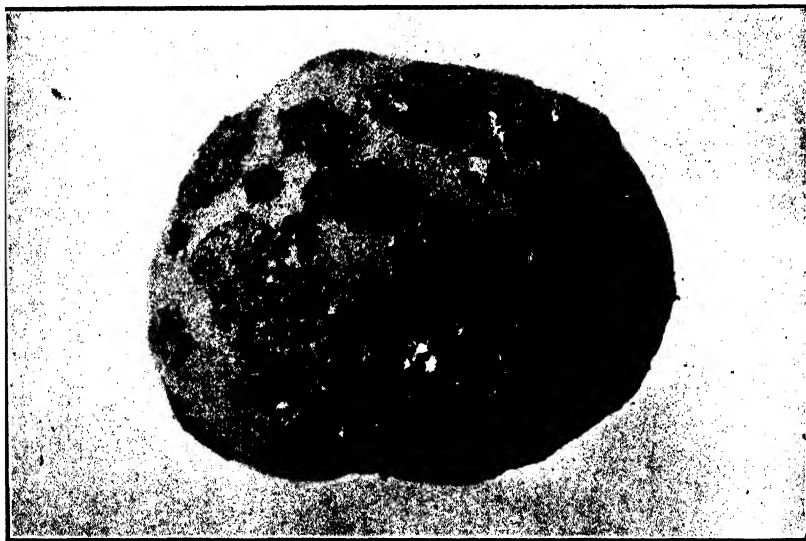
From the foregoing it can be seen that the Australian authorities have, in their own estimation, no lack of good reasons why it is necessary to prohibit the introduction of New Zealand potatoes. It will now be well to give some consideration to the disease itself, and also to its position in the potato-growing industry of this country.

THE DISEASE AND ITS INCIDENCE.

Powdery scab is caused by a very lowly organism belonging to what are termed the slime fungi (*Myxomycetes*). This group of organisms, which in their vegetative characters have much in common with certain phases of animal life, and in their reproductive characters closely resemble certain of the true fungi, contains many well-known plant-



POTATO ATTACKED BY POWDERY SCAB (*SPONGOSPORA SUBTERRANEA*).
Showing ruptured pustules.



TUBER ATTACKED BY ORDINARY POTATO-SCAB (*ACTINOMYCES* SP.).

[Photos, E. B. Levy.

parasites. Amongst the most destructive of these may be mentioned club-root (*Plasmodiophora brassicae* Wor.) and black-wart disease (*Chrysophlyctis endobiotica* Schilb.). Powdery scab was first brought under scientific notice some seventy years ago, but to growers in Central Europe it was well known prior to that time under the popular name of *Karloffelrande*. Since it was first named and described in 1841 powdery scab has had a most chequered career in the hands of many mycologists. To quote Dr. Pethybridge (First Report, "Potato Diseases in Ireland," 1910), "Not only has it changed its name several times, and been chased from one group of fungi to another, but it has been overlooked altogether and then been rediscovered and again renamed, till finally under this last guise (*Spongospora subterranea* (Wall.) John.) its presence in Ireland was first announced [by Johnson] about five years ago, although it has probably been here unrecognized for many a long year."

During the past decade very considerable attention has been given to powdery scab by plant pathologists, not on account of any increase in its destructiveness, but largely on account of its interesting botanical history, and owing to the fact that its presence had in many countries either been overlooked or confused with ordinary scab (*Actinomyces* sp.), a disease that is present in all potato-growing countries. Soon after the publication of Professor Johnson's original papers on the occurrence of powdery scab in Ireland it was found to be common in many countries, such as England, Scotland, Canada, the United States, and New Zealand, where previously its presence had been quite overlooked. It can very truly be said of powdery scab that its importance as a potato-disease can be traced rather to the work of the plant pathologist than to any actual damage it causes to potato-production.

Spongospora scab is generally quite easy to distinguish from ordinary scab by its more regular lesions, their frayed edges of upturned potato-skin, and the brownish powdery material with which the scabs are filled. Each grain of powder consists of what is termed a spore-ball, consisting of a sponge-like mass of spores. In the early stages of attack the lesions take the form of isolated pimple-like developments of the potato-skin. Later on these pimples or warts burst, leaving the powdery spore-mass exposed. The spores are scattered with great ease and are liable to be distributed throughout the soil where an infected crop is grown, and can, it is said, retain their vitality in soil for a period of several years. Distribution of the disease is readily occasioned not only by the transport of diseased tubers, but by means of infected soil, sacks used for bagging an infected crop, and by many other means.

So far as New Zealand is concerned the disease has been known positively to exist since 1909, but there is no doubt that it was present many years prior to that date, being confused with ordinary scab until the publication of its occurrence in Ireland in 1908. Since 1909 it has been frequently noted, especially in the more southern portions of the South Island.

As soon as the embargo was placed on the export of potatoes to Australia the Department made a rapid survey of the potato districts of Canterbury (Australian export being in general almost wholly from that province) in order to ascertain whether or not there were any districts wholly free from powdery scab. This investigation has shown

that there are localized areas where the disease cannot be found, but in nearly every case the boundaries of the clean areas or clean groups of crops are limited by areas where traces of powdery scab can be found. Thus, for instance, powdery scab is more or less prevalent over all the country south of the Ashburton River, while north of that boundary, except in the Yaldhurst, Styx, and Marshlands districts, near Christchurch, powdery scab is exceedingly rare, and over comparatively wide areas has not been found. As, however, free interchange of seed-potatoes has occurred for many years past, irrespective of whether they have been grown from a clean or diseased crop, it is possible that the disease may be found in isolated areas in those districts which departmentally are considered to be clean. It is not unlikely that the localized areas investigated by the Australian expert may be considered too small or too contiguous to diseased crops to allow the embargo to be lifted. Even if export is finally allowed from one or more of the present reputedly clean areas, this will not alter the fact that owing to the prevalence of the disease many of our main areas will not be in the same position.

THE QUESTION OF ERADICATION.

In consequence of this position it is necessary to consider whether some effort for the eradication of powdery scab from New Zealand should not be made. For myself, I am rather of the opinion that it will be recognized sooner or later in Australia that too much emphasis has been given to the dangerous character of the disease. Its presence in nearly all important potato-producing countries and the scant notice taken of it except in regions where it has not been reported present seem to indicate that its harmfulness has been enormously exaggerated. So far as New Zealand is concerned, were it not for the fact that it is banning export to Australia no notice whatever would be taken of the disease. In one of our most important potato areas it has been present for many years past without having had the least effect on the production or quality of the potatoes produced. When such a fact as this is considered it appears ridiculous to suggest that special methods of eradicating the disease are imperative. It may be contended, however, that ability to export potatoes freely to Australia is necessary both from the point of view of the grower and the consumer—in the one case to enable the profitable disposal of any surplus, and in the other so that adequate supplies at reasonable prices may be produced each year.

Thus, it follows that it is advisable to make an effort to eradicate powdery scab. The fact that even in districts where the disease is most prevalent only a very small percentage of the tubers become affected indicates that only a slight modification of practice might lead to eradication. Two factors that should lead to the rapid elimination of the disease appear to be obvious—namely, the use of disease-free seed only, and the growing of potatoes on the same land only once every seven years. It might be advisable also to avoid growing tomatoes on land that had been in potatoes during recent years, as there is experimental evidence that powdery scab can form nodules on tomato-roots.

One of the main difficulties with regard to disease-free seed is that in certain districts it might be impossible to secure seed from a crop

that is absolutely free from the disease. In such a case it would be advisable to dip all seed used in either 2-per-cent. bordeaux mixture or formalin 1 pint to 30 gallons of water. This would destroy all spores that might be on the surface of the tubers, but it is not always satisfactory where some of the spore-pustules have not burst open. I recognize that the dipping of potato-seed, where such a large quantity (15 cwt. or more) is used per acre is a troublesome operation, but it must be remembered that such treatment is effective against ordinary scab, which is, of course, a much more serious disease in New Zealand than powdery scab.

GRASS-GRUB CONTROL.

EXPERIENCE AT RUAKURA.

A. W. GREEN, Manager, Ruakura Farm of Instruction.

A CASE indicating the efficiency of soil-trampling by heavy live-stock as a practical means of controlling attacks of the grass-grub (*Odontria zealandica*), in certain circumstances, has occurred at Ruakura this year.

In February last the wilting of large patches of grass pasture in one of the fields (No. 9) bespoke the active presence of the grub, and this was confirmed by examining the ground. Shortly afterwards a maize crop became available for feeding out to the dairy herd, and arrangements were made whereby this fodder was fed on the affected areas of the field. The result was a thorough trampling of the ground by the cows. Later on, during the winter, the same procedure was repeated with hay and mangolds. The grub-infested areas made a steady recovery from late autumn onwards, and by spring-time the grasses and clovers were growing almost normally on them. The process has been assisted by the germination of grass-seed shed from the hay when feeding and tramped into the ground by the cattle. The hay contained considerable quantities of clover seed-heads, and as clover-seed passes through cattle unharmed the establishment of clovers on the infested patches followed.

The concentration of cattle on these areas gave a further benefit, for in consequence the land received a heavy dressing of animal-manure. Subsequent to the stocking the land was chain-harrowed, thereby turning to profitable account the animal droppings.

The foregoing, however, does not comprise all the data. A control area, greatly increasing the value and interest of the demonstration, was automatically provided by a wire-fenced enclosure surrounding the soldier-trainees' quarters, which are situated in the field in question. Large parts of this enclosure were affected by the grub, including ground conterminous with grubby patches in the open field. The ground inside the fence was planted here and there with shrubs, and, of course, could not be subjected to the trampling process. On these enclosed patches the grass was practically killed out and the ground became bare.

It may be mentioned that in this case the rye-grasses were the first to suffer from the attack of the grub, while cocksfoot proved the most

resistant. Among the clovers, alsike and white soon succumbed, while red clover retained its roothold longest.

The trampling action of heavy cloven-footed beasts is great, especially with a herd moving about after fodder. This was borne out by an examination of the soil of the treated patches, which revealed numbers of crushed grubs, those that escaped having no noticeable effect. Such trampling is undoubtedly far more effective than rolling, where the pressure is distributed over a much larger area.

The method here outlined is not based on the results of one season's experience, for in the autumn of 1915 several acres of grassland infested with grass-grub received similar treatment, with the exception that turnips and mangolds only were fed out. Regrassing in this case was accomplished by the surface-sowing of grass and clover seeds and harrowing. Another field (No. 18) was badly infested with grass-grub during the autumn of 1918. Treatment on exactly the same lines as that given to field No. 9 and described in detail in this article destroyed the grubs and renovated the grass pasture. This is now one of the best pastures on Ruakura.

It is not claimed that the control plan here described could be carried out everywhere, or where the attack of the grub is widespread over the whole of the pasture of a farm. Attack, however, is very commonly confined to limited areas, and in such cases a simple adaptation of farm practice on the lines given will afford good prospects of successfully controlling the pest, especially in dairying districts where both cattle and fodder crops are available. Few dairy-farmers would wish to break up their best pastures in an endeavour to eradicate grass-grub by cultivation, which means that for the sake of dealing with comparatively small patches the whole of the field has to be ploughed up.

Farmers may be advised to especially watch for the grub on the lighter classes of land. The experience at Ruakura has been that the grub will be usually found in light loam, or loam over a gravel subsoil, rather than in heavy land with a clay subsoil. In the Auckland District the land varies considerably, and even in a comparatively small field the two extremes may be found. Such was the case in all the fields already referred to in this article. Patches of lighter land varying from 3 to 9 acres were affected, while the remaining areas of the fields varying from 12 to 21 acres were unattacked.

Returned Soldiers at Ruakura.—The quarters for soldier trainees at the Ruakura Farm of Instruction are now being doubled, enabling sixty men to be accommodated, compared with the present thirty. The new building will include a good-sized lecture-hall.

Sepsis in Dairy Cows.—In connection with the mortality from sepsis experienced in certain districts this season, farmers concerned may be reminded that this condition was dealt with and preventive measures described by Mr. A. R. Young, Director of the Live-stock Division, in the first article of his series on the "Management of Dairy-farm Stock," published in the *Journal* for August, 1919, pages 69-70.

AN ECONOMIC INVESTIGATION OF THE MONTANE TUSSOCK-GRASSLAND OF NEW ZEALAND.

VIII. AN EXPERIMENT IN CENTRAL OTAGO CONCERNING THE RELATIVE PALATABILITY FOR SHEEP OF VARIOUS PASTURE-PLANTS.

Dr. L. COCKAYNE, F.N.Z.Inst., F.R.S.

GENERAL.

THROUGHOUT this series of articles stress has been laid upon the importance of procuring reliable information regarding not only what pasture-plants are eaten by sheep, but the actual sequence in which they are eaten, the latter being termed their "relative palatability." The methods employed for determining such palatability are twofold—namely, (1) observing sheep feeding on the pastures and noting the plant or plants which have just been eaten and those other species in close proximity which are untouched, no evidence being accepted except the finding of the actual portion of the plant which has been bitten by the sheep; and (2) grazing an excessive number of sheep on a quite small area for a number of days, and taking careful notes regarding the sequence in which the various species are being eaten and the general effect upon the pasture of the grazing at certain periods throughout the experiment.

As the result of the actual field observations of grazing much evidence is accumulating, numerous observations having been made on the back-country sheep-runs throughout much of the South Island. These observations, when they reach a number amply sufficient to eliminate any errors of observation, will be tabulated and the results published in this *Journal*.

With regard to the experimental method it must be pointed out that the results of each experiment refer only to the actual locality where the experiment was conducted and to the conditions under which it was carried out—*e.g.*, the breed, age, and sex of the sheep; the time of year when the grazing took place; the state of the weather during the time of the experiment and for the particular year; the actual condition of the various pasture-plants at the time the experiment commenced; the kind of pasture the sheep had occupied prior to their being transferred to the experimental area; and the condition of the sheep at the commencement and the conclusion of the experiment.

Obviously the evidence derived from these palatability experiments can lay no claim to its general applicability; nevertheless, it is evident that it does suggest a good deal as to the nature and direction of further observations, and that it can be compared with the more natural field observations. Indeed, if the latter—taken as they are from the whole of the mountain sheep-runs—and the results of the experiments coincide, then an accurate knowledge of the relative palatability of the pasture-

plants—that fundamental basis for advance in the improvement of the runs generally—will be pretty nearly attained.

Prior to the experiment here being dealt with two other experiments had been carried out in connection with the montane tussock-grassland investigation. A detailed account of both has appeared in this *Journal* (June, 1919, and April, 1920). Suffice it to say here that the climatic conditions of Hanmer Plains, in the immediate neighbourhood of which the former experiments were conducted, are altogether different from those of the arid area of Central Otago. Also, the length of time allotted to these experiments was not long enough to enable a true estimate to be gained of the relative palatability of some of the pasture-plants. Nevertheless, certain points stood out clearly, and these become of greater interest when compared with the Central Otago results, since they tend to show that climates of an opposite character permit a similar degree of palatability for certain species. But this phase of the subject is to be dealt with in the next part of this series of articles.

In article II of this series (*Journal*, June, 1919, p. 322) I stated, "From what I have observed sheep do not take their food haphazard; they distinctly select—their feeding, indeed, may be called 'selective.' " The many field observations made since this was written strongly confirm this statement; so, too, does the Central Otago experiment. But the latter also shows that a certain species clearly proved to be of the highest palatability, such as cocksfoot, is occasionally neglected when species of undoubtedly lower palatability are present. Occurrences of this kind happen so rarely, however, that they may be considered negligible. Further, the relative palatability of a plant is especially demonstrated when it is eaten out of a pasture, while alongside these fully grazed plants, cropped close to the ground, remain in more or less abundance the plant or plants which on rare occasions were preferred. For a species named A to be of higher palatability than a species named B, A in a considerable number of cases must be eaten when B side by side with it remains untouched. If, however, A and B are plants of high though not of equal palatability, and they occur at considerable distances from one another—i.e., they do not compete—then both may be eaten equally. Thus, while cocksfoot was being closely cropped in one part of the experimental area, the less palatable catscar was being eaten to the ground in another part.

From what has just been said an important question arises regarding plants of relatively low palatability—i.e., whether such in the absence of species of higher palatability will be as good feed as the latter. The answer to this question can only be found out by experiment, and for this purpose small areas of pure pasture of the grass or herb to be tested must be provided. Such an experiment would prove whether or not a plant of low palatability—e.g., blue grass (*Agropyron scabrum*)—capable of supplying abundant winter feed, might be introduced in quantity with advantage on to certain classes of winter country. On the other hand, it seems probable that the degree of palatability may stand in some relation to the degree of nutritive quality, so that the more palatable the more nutritious. Clements ("Plant Indicators," p. 286; Washington, 1920), using the evidence given by chemical analysis of many pasture-plants, considers that "differences in palatability are much more important than those of nutrition-content," and further states, "It is surprising to find some grasses which ordinarily are grazed

little or not at all possessing as high a nutrition-content as the best species of the range" [run].

In this account of the experiment full details regarding the palatability of each species occurring in the Earnsclough area are not given, but such will form the subject of the next article of the series. Nor is a detailed account attempted of what happened day by day, since, owing to the nature of the plant-covering, such would be misleading without much tedious explanation. This plant-covering is far from uniform, as will be seen farther on, and as the sheep did not confine themselves to one spot, but grazed all over the area, different combinations of species with regard to palatability were being grazed on simultaneously; that is to say, species were being eaten in one place but neglected in another where more palatable species were present. Thus the account of the results, as given below, has been gleaned from a mass of evidence, which had to be sifted with great care.

THE CENTRAL OTAGO PALATABILITY EXPERIMENT.

The Experimental Area.

It is by no means easy to find suitable small enclosures for carrying out experiments in palatability. Fortunately, the Earnsclough experimental area, near Clyde, though designed for a different purpose, is almost ideal. This area has been already described in this series of articles and details given of its plant-covering (*Journal*, February, 1920, p. 88). Here it need only be stated that the area was originally enclosed with a rabbit-proof fence in order to carry out certain experiments having a bearing on regrassing the depleted parts of Central Otago. Accordingly the lower part of the enclosure was cultivated and a considerable number of pasture-plants sown, some pure and in rows, and some as mixtures over wider areas. But the steepest portions of the ground were either let alone or surface-sown in places. The result has been that the cultivated portion of the land is now occupied by a rich vegetation, consisting chiefly of cocksfoot, lucerne, tall oat-grass, red fescue, and Chewings fescue. There is also a good deal of yarrow and sheep's burnet, and a fair amount of red clover and chicory. There are also a good many other grasses and herbs, but the names of these, English and scientific, may be seen in the list of species at the end of this article. Unfortunately, a good many of the species sown either did not germinate or have died.

In addition to these exotic plants, purposely introduced, others have come unbidden, together with a number of indigenous species, denizens of the original grassland, the most important being blue-grass and tall blue-tussock. Altogether, counting those species which could be reached by the sheep, there were about eighty species available for testing their relative palatability.

The original enclosure had an area of about 20 acres, but in order to provide water for the sheep about half an acre, which takes in part of a running stream (Picnic Creek), has been added.

As one of the special objects of the experiment was to discover the true palatability values of certain indigenous grasses, when not competing with plants of known higher palatability, an area of $\frac{2}{3}$ acre, containing a good many plants of the species to be tested, was fenced off from the remainder of the area (see Fig. 1). In what follows this is called "the small enclosure."



FIG. 1. CENTRAL OTAGO PALATABILITY EXPERIMENT: THE SMALL ENCLOSURE ON EARNSCLEUGH AREA.

Showing great abundance of catsear in foreground and centre.



FIG. 2. PART OF EARNSCLEUGH AREA.

On left, portion of depleted ground added to the area by removal of fence. On right, part of cocksfoot slope before the experimental grazing commenced.

[Photos, W. D. Reid.

Soil, Climate, and Condition of the Vegetation.

The soil is that rich mica-schist soil so characteristic of Central Otago. Apart from the level ground adjacent to the lower fence the condition of the soil is governed by the degree of slope and the aspect. The upper soil of the level ground consists of a fine black loam, 5 in. to 6 in. deep. The subsoil—10 in. in depth—is a rather stiff clay overlying a bed of coarse sand intermingled with many small stones. On the hillside the more gentle the slope the greater is the depth of humus and freedom from stones, but aspect plays a notable part, so that the depth of the upper soil on sunny faces is much less than that on semi-shady and shady faces. The nature of the subsoil for all the slopes is fairly constant. It varies in depth from 8 in. to 2 ft., and at a depth of 12 in. is coarse, sandy, and mixed with broken stones; at a greater depth large boulders are present. On sunny faces humus is absent in many places. On the eastern and south-eastern slopes there is good black loam, 4 in. deep, and more or less free from stones. There are a good many outcrops of rock, especially on the higher parts of the area.

Owing to the extremely steep character of so much of the surface only a continuous rain can sink into the soil for any distance. Apart from lucerne, sorrel, and certain shrubs, few of the species send down their roots more than 2 ft., at which depth during summer the soil is extremely dry. Such dryness of the soil is not to be wondered at, for the average annual rainfall of the neighbourhood is only some 14 in., and the average number of rainy days sixty. In 1919-20, up to the time the experiment commenced, there had been a prolonged period of drought, hardly any rain having fallen since October, 1919. Moreover, the summer was excessively hot, no less than 100° F. having been registered in February, while 90° F. and over had not been uncommon.

From what has been said in the last two paragraphs it is clear that the vegetation should have reached its maximum condition of dryness. But in this respect the state of the plants was not uniform throughout the area—an excellent circumstance in view of the experiment. In a good deal of the sown area the lucerne, cocksfoot, tall oat-grass, and certain other plants had been cut for hay before Christmas, such cut plants in their young growth offering a different test for palatability to the old, uncut plants with their hard stems, many of which plants had grown unmolested for eight or nine years. Then, on one of the steep slopes there had been a grass-fire some two years before, and the burnt tussocks had grown very slowly and their leaves were more succulent than those of the unburnt tussocks. Certain species also offered a different class of feed according to their aspect with regard to sun and shade. Finally, young and old plants offered a different class of feed. Thus, although there were only eighty species, these represented far more than that number so far as relative palatability was concerned.

The stems of the old uncut lucerne, tall oat-grass, and cocksfoot were very hard and dry; meadow-grass and rye-grass were generally almost completely burnt up, and their dry brown leaves looked most unpalatable; indeed, excepting the three indigenous tussock-grasses, the plants as a whole differed greatly in appearance from the same species growing in a locality with a reasonable rainfall. But this was all the better for the test, since in arid Central Otago dried-up foliage and hard stems are the rule in summer. If exotic grasses and herbs

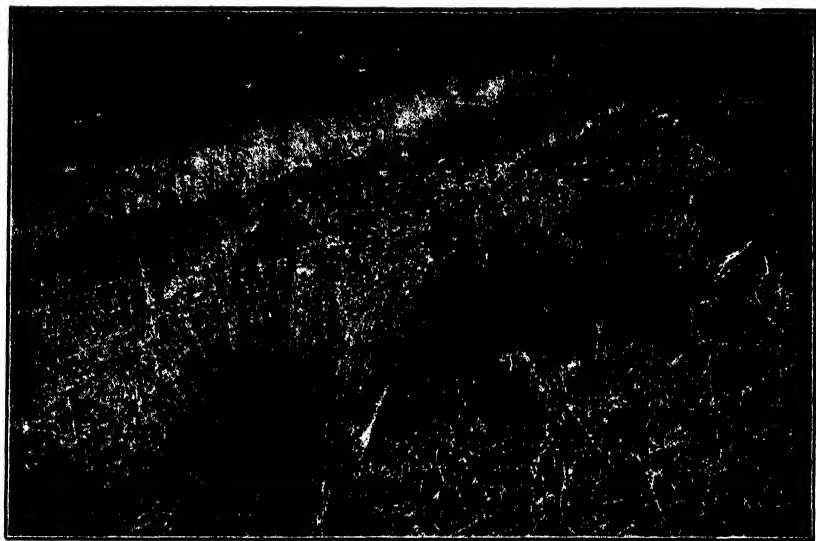


FIG. 3. FESCUE-TUSOCK (COMMONEST TUSOCK-GRASS OF THE SHEEP-RUNS) REMAINING UNEATEN AT CLOSE OF EXPERIMENT.



FIG. 4. COCKSFOOT AND OTHER PLANTS SHOWN IN FIG. 2 AT CONCLUSION OF EXPERIMENT.

Had the sheep been kept longer on the area the remaining dry cocksfoot-stems shown in photograph would have been eaten.

[Photos, W. D. Reid.]

are to be substituted for those which are indigenous, they must be judged from their summer condition in a dry climate, for their palatability under ordinary circumstances in wetter localities can be no criterion as to their value in arid, depeted areas.

The Actual Experiment.

It has already been explained that the pasture on which the sheep were to be grazed was far from uniform in its composition. The following were its most distinct types of vegetation: (1) The sown area, much of which, before Christmas, had been cut for hay; (2) the sown but uncut area, to be subdivided into the cocksfoot slope (see Fig. 2), and the Chewings fescue bank; (3) the unsown catsear area; and (4) the indigenous-tussock area. Throughout these areas were many patches, some fairly large, where certain species occurred in quantity—e.g., yarrow, sheep's burnet, chicory, meadow-grass (*Poa pratensis*), red-top, Yorkshire fog, and red clover. Other plants occurred in but few places—e.g., sainfoin (*Onobrychis viciaefolia*), birdsfoot trefoil (*Lotus corniculatus*), alsike (*Trifolium hybridum*), twitch (*Agropyron repens*), and woodrush (*Luzula campestris* var.—indigenous). The indigenous tussocks, though occurring principally on the dark faces, were also here and there side by side with the specially palatable species, while a row of fescue-tussock had been established from seed in the cultivated portion of the area (see Fig. 3).

The sheep used in the experiment were kindly lent by Mr. J. Faisandier, whose orchard and farm is in close proximity to the experimental area. The sheep were therefore merely moved, as it were, from one paddock to another. They numbered three hundred, and consisted of crossbred ewes and lambs. Previous to their being put on the area they had been grazing for a considerable time on an irrigated pasture consisting of (in order of relative abundance) meadow-grass, white clover, crested dogtail, rib-grass, catsear, and cocksfoot. At the time the experiment commenced the sheep were in fair condition, and at its conclusion were in the majority of cases in better condition than when the experiment commenced. Therefore, throughout the experiment there was no time when there was not abundance of feed at the disposal of the animals. Even on the last day the cocksfoot slope was far from being eaten bare (see Fig. 4).

On 20th February, 1920, shortly after 10 a.m., twenty of the sheep were put into the small enclosure, and an hour and a half later the remaining 280 sheep were turned on to the remainder of the pasture. Notwithstanding that the sheep had been suddenly transferred from a green irrigated paddock to the burnt-up vegetation of a dry hillside they commenced feeding heartily at once. This may be partly accounted for by the fact that though not really hungry they had not been getting an abundant allowance of food. Those in the small enclosure made a beginning on the dry seed-stalks and seed-heads of the catsear (see Fig. 1), while the remainder of the sheep remained on the sown area and confined their attention to the lucerne and cocksfoot. Other species eaten to some extent the same day on this last-named area were red clover (the seed-pods), catsear, and sheep's burnet.

On the second day, in addition to the foregoing species, which were still being eaten freely, birdsfoot trefoil, sainfoin, alsike (the seed-pods),



FIG. 5. SHEEP EATING YARROW IN PRESENCE OF LUCERNE, BLUE-GRASS, AND TALL OAT-GRASS.



FIG. 6. CHEWINGS FESCUE (ON RIGHT) NOT EATEN, BUT COCKSFOOT AND LUCERNE (ON LEFT) EATEN TO GROUND.

Later the fescue was eaten closely.

[Photos, W. D. Reid.]

and dry, thick stems of lucerne were eaten. In the small enclosure the sheep continued feeding on the catsear, but an occasional nibble was made at a blue-grass tussock.

On the third day a few sheep left the sown ground and ascended to the summit of the area, but throughout the experiment by far the greater part remained on the sown area, although enough visited the catsear slope to finally entirely dispose of that plant, though most abundant, and leave the ground quite bare.

On the fourth day yarrow was eaten (see Fig. 5), and so greatly was this enjoyed that in a few days not merely were the leaves and erect stems disposed of, but the underground stems were laid bare. Strange to say, the dry portions of the plant were greatly preferred to the green.

By the eleventh day—leaving aside what happened in the small enclosure—the extent to which the species had been individually grazed was as follows:—

Cocksfoot: Where cut it had been closely eaten. The uncut plants on the hillside had been reached by the sheep on the sixth day, but though eaten continuously a large amount of both green and dry growth remained.

Lucerne: Where cut it had been greatly eaten. Uncut plants had been stripped of leaves; the upper parts of the stems had been eaten, but the lower parts of these still afforded food.

Red clover: By the eighth day all this had been eaten, but it must be remembered there was not a great deal originally.

Catsear: This had been greatly eaten, especially after rain, but there still remained a good deal.

Yarrow: All except the green leaves and young growth was eaten by the ninth day.

Sheep's burnet: The stems had been stripped of their leaves, but young growth was still supplying feed.

Alsike: Seed-heads, stems, and leaves had all been eaten.

Chicory: The erect stems had been stripped of leaves, but a small amount of growth at the base of the stems still supplied food.

Yorkshire fog: Green plants in the more shady places had been eaten, but in exposed positions the plant had not been eaten to any extent.

Woodrush: The leaves had been eaten closely.

Sowthistle: Both stems and leaves had been closely eaten.

Rib-grass: The leaves had been eaten close, but the flower-stems and seed-heads had not been eaten.

Chewings fescue: A good deal had been eaten, but it must be borne in mind it did not compete with lucerne and cocksfoot. Where it did so compete it was not eaten until the two last-named species were disposed of (see Fig. 6).

Red fescue: It was only where this formed a pure pasture that it was eaten.

Sainfoin: The few plants had been stripped of leaves, but the stems were untouched.

Birdsfoot trefoil: Leaves and young growth had been eaten, but not the old stems.



FIG. 7. COCKSFOOT TUSSOCKS (IN CENTRE) EATEN TO GROUND.

The tall tussocks, remaining at end of experiment, are tall oat-grass and the two kinds of canary-grass.

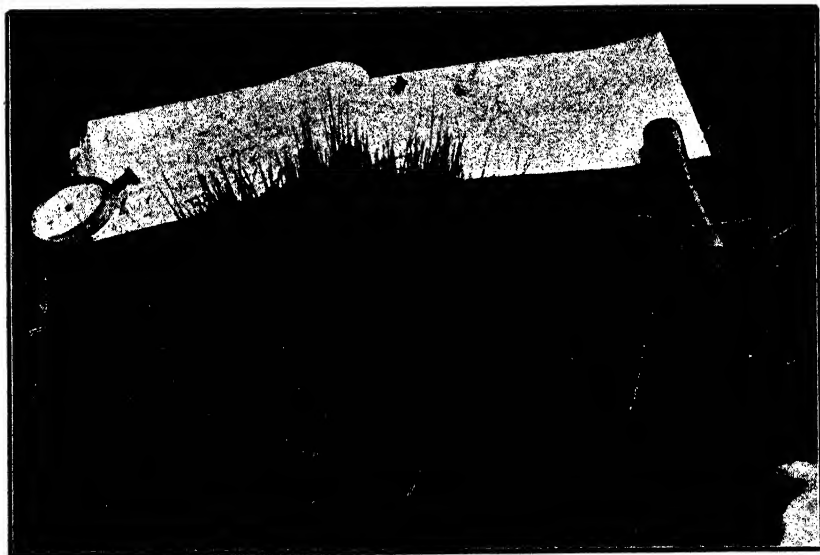


FIG. 8. TALL BLUE-TUSSOCK EATEN IN THE SMALL ENCLOSURE.

Sorrel : This is not a common plant of the area ; it had been eaten very little.

Sweet vernal : Where green a small amount had been eaten.

Red-top : The seed-heads in a few instances had been eaten.

Rye-grass : This had been eaten to a very limited extent if there were green leaves.

Meadow-grass : This was extremely dry ; where there were a few green leaves they had been eaten.

White clover : The few plants had been only partly eaten.

Tall oat-grass : This had been very lightly grazed, but the general effect was not noticeable (see Fig. 7).

Blue-grass : Although this was being eaten the bulk of the fodder had been reduced only to a very limited extent.

Hawksbeard : Up to the time in question only the seed-heads had occasionally been eaten.

Tall blue-tussock : Only young plants had been eaten.

Smooth-leaved mullein : A few plants showed signs of having had their leaves eaten.

Vetch : This had been eaten only to a slight extent.

The following species had not been eaten : Winged thistle, twitch, sterile brome-grass, soft brome-grass, pipiriri, wild-irishman, sweetbrier, pink willowherb, common dock, plume-grass, fescue-tussock, and the two species of *Phalaris*.

When the specially palatable feed on the sown area was consumed more sheep grazed on the slopes, and, though that covered with cocksfoot was the favourite place, sheep visited all the other parts of the area. In consequence, various plants of medium and low palatability had few or no competitors, and so were eaten more or less. In this category came the following : Dry meadow-grass (*Poa pratensis*), eaten close ; blue-grass, often eaten to the base, but more frequently only partly eaten ; tall blue-tussock, not nearly eaten to the same extent as blue-grass ; twitch, especially where it had been cut ; the two fescues, but the smaller one more especially ; green Yorkshire fog ; one of the hooked sedges (*Uncinia*) ; a dwarf sedge (*Carex Colensoi*) ; dry winged thistle ; young fescue-tussock.

Coming now to what happened in the small enclosure of $\frac{3}{8}$ acre in extent, early in the experiment three of the twenty sheep confined on this area jumped over the fence. On the eleventh day the sheep were let out in order that they might go to the water, and the next day forty-four sheep were put on to the area and kept there for five days.

The species of the small enclosure were the following : Catsear (very abundant—see Fig. 1), Yorkshire fog (plentiful), blue-grass and blue-tussock (abundant), dried up annual fescue (a fair amount) ; and, in a small amount (very little in some cases) hawksbeard, cocksfoot, woodrush, dry winged thistle, pipiriri, hair-grass, desert-broom, soft brome-grass, barley-grass, sweet vernal, sweetbrier, sorrel, common dock, and fescue-tussock.

By the tenth day the following had occurred : Catsear had been eaten greatly, but there was still a large quantity ; the young leaves of Yorkshire fog had been eaten, but the dry parts were untouched ; blue-grass was eaten to a small extent ; tall blue-tussock was eaten much less than blue-grass ; rye-grass (dry) was only lightly eaten ; sweet

vernal was eaten slightly; desert-broom was eaten slightly. The remainder of the species were apparently untouched.

With the increase of the sheep to forty-four the grazing became more intense. A good many tussocks of blue-grass were closely cropped; catsear was eaten out completely; desert-broom was much more freely eaten; burnt tall blue-tussock and blue-grass were both eaten to the ground; some tussocks of blue-grass were closely eaten, but many were not eaten at all; tall blue-tussock was eaten at times (see Fig. 8); dry winged thistle was eaten fairly heavily; heads of sweet vernal lay uneaten on the ground.

At the end of this palatability experiment, except on the cocksfoot slope, all the plants of high palatability were eaten close, but many were making considerable growth, a sign that for the time being the pasture had not been overstocked. The plants of medium palatability were also mostly cropped close. Certain species had the leaves eaten but not the dry stalks—e.g., the two kinds of fescue. Tall oat-grass, canary-grass, and fescue-tussock were hardly eaten at all. The latter remained untouched either in the presence of blue-grass or of blue-tussock, or when all the competing plants in the vicinity had been eaten to the ground (see Fig. 3). A list of the plants apparently not eaten at all will appear in the next article of this series.

LIST OF SPECIES GROWING ON THE EARNSCLEUGH EXPERIMENTAL AREA.

The sign * attached to a name indicates that the species is indigenous.

Scientific Name.	Popular Name.
1. GRASSES AND GRASSLIKE PLANTS.	
* <i>Agropyron repens</i>	Twitch.
— <i>scabrum</i>	Blue-grass.
<i>Agrostis tenuis</i> (<i>vulgaris</i>)	Red-top.
<i>Aira caryophyllea</i>	Hair-grass.
<i>Anthoxanthum odoratum</i>	Sweet vernal.
<i>Arrhenatherum elatius</i>	Tall oat-grass.
<i>Bromus hordeaceus</i> (<i>mollis</i>)	Soft brome-grass.
— <i>sterilis</i>	Sterile brome-grass.
* <i>Carex resectans</i>	Desert-sedge.
— <i>Colensoi</i> .. .. .	.. .. .
<i>Dactylis glomerata</i>	Cocksfoot.
<i>Dichelachne crinita</i>	Plume-grass.
<i>Festuca gigantea</i>	Giant-fescue.
— <i>myuros</i>	Annual fescue.
* — <i>novae-zelandiae</i>	Fescue-tussock.
— <i>rubra</i> var.	Red fescue.
— "	Chewings fescue.
<i>Holcus lanatus</i>	Yorkshire fog.
<i>Hordeum murinum</i>	Barley-grass.
<i>Lagurus ovalis</i>	Harestail-grass.
<i>Lolium perenne</i>	Rye-grass.
* <i>Luzula campestris</i> var.	Wood-rush.
<i>Phalaris bulbosa</i>	Bulbous canary-grass.
— <i>commutata</i>	Canary-grass.
<i>Poa annua</i>	Annual poa.
* — <i>intermedia</i>	Tall blue-tussock.
* — <i>maniototo</i>	Desert-poa.
— <i>pratensis</i>	Meadow-grass.
* <i>Scirpus cernuus</i>	Nodding club-rush.
* <i>Triodia Thomsoni</i>	Otago triodia.

LIST OF SPECIES—continued.

Scientific Name.	Popular Name.
2. HERBS AND SEMI-WOODY PLANTS.	
* <i>Acaena Buchananii</i>	Pale pipiriri.
* <i>— novae-zelandiae</i>	Red pipiriri.
* <i>— Sanguisorbae</i> var. <i>pilosa</i>	Mountain-piripiri.
<i>Achillaea Millefolium</i>	Yarrow.
* <i>Aciphylla Colensoi</i>	Spaniard.
<i>Anagallis arvensis</i>	Scarlet pimpernel.
* <i>Blechnum penna marina</i>	Alpine hard-fern.
<i>Carduus pycnocephalus</i>	Winged thistle (usually called "star-thistle" in Central Otago).
<i>Cerastium triviale</i>	Larger mouse-ear.
* <i>Cheilanthes Sieberi</i>	Common lip-fern.
<i>Cichorium Intybus</i>	Chicory.
<i>Crepis capillaris (virens)</i>	Hawksbeard.
* <i>Epilobium cinereum</i> var.	Pink willowherb.
* <i>— nerlerioides</i>	Wrinkled willowherb.
* <i>— pedunculare</i> var.	Long-stalked willowherb.
* <i>Erechtites quadridentata</i>	White fireweed.
<i>Erodium Cicutarium</i>	Hemlock-storksbill.
* <i>Galium umbrosum</i>	New Zealand bedstraw.
* <i>Geranium sessiliflorum</i> var. <i>glabrum</i>	Short-flowered cranesbill.
<i>Hypochaeris radicata</i>	Catsear (frequently called "capeweed" and often mistaken for dandelion).
<i>Lotus corniculatus</i>	Birdsfoot trefoil.
<i>Marrubium vulgare</i>	Horehound.
<i>Medicago maculata</i>	Spotted burr-clover.
<i>— sativa</i>	Lucerne.
<i>Myosotis</i> (species not yet identified)	Forget-me-not.
<i>Onobrychis viciaefolia</i>	Sainfoin.
* <i>Oxalis corniculata</i>	Yellow oxalis.
<i>Plantago lanceolata</i>	Rib-grass.
* <i>Polystichum Richardi</i>	Hard shield-fern.
<i>Poterium Sanguisorba</i>	Sheep's burnet.
* <i>Raoulia Beauverdii</i>	Otago raoulia.
* <i>— lutescens</i>	Scabweed.
<i>Rumex Acetosella</i>	Sorrel.
<i>— crispus</i>	Curled dock.
* <i>Solanum nigrum</i>	Black nightshade.
<i>Sonchus oleraceus</i>	Sowthistle.
* <i>Stellaria gracilentia</i>	Mountain-chickweed.
<i>Trifolium hybridum</i>	Alsike.
<i>— pratense</i>	Red clover.
* <i>— repens</i>	White clover.
<i>Uncinia</i> (species not yet identified)	Hooked sedge.
* <i>Urtica aspera</i>	Mountain-nettle.
<i>Verbascum Blattaria</i>	Smooth-leaved mullein.
<i>Vicia</i> (species not yet identified)	Vetch.
3. SHRUBS.	
* <i>Carmichaelia Petriei</i>	Thick-stemmed broom.
* <i>Coprosma propinqua</i>	Common coprosma.
* <i>Discaria toumatou</i>	Wild-irishman (usually called "mata-gourie" in Otago).
* <i>Hymenanthera dentata</i> var. <i>Alpina lupinus arboreus</i>	Tree-lupin.
* <i>Olearia odorata</i>	Odorous tree-daisy.
<i>Ribes Grossularia</i>	Gooseberry.
<i>Rosa Eglantheria (rubiginosa)</i>	Sweetbrier.
* <i>Rubus subpauperatus</i>	Narrow-leaved lawyer.

TOPICAL NOTES ON SOME DISEASES OF LIVE-STOCK.

A. R. YOUNG, M.R.C.V.S., Director of the Live-stock Division.

CONTAGIOUS ABORTION IN CATTLE.

THIS troublesome and well-known disease has caused immense losses in New Zealand as in other affected countries, but it does not by any means appear likely to become so great a scourge here as in some other lands. The position, however, is serious enough to warrant us in considering every possible means likely to bring about the eradication of the disease, and there is no doubt that the sanitary methods adopted by farmers in the past have been the means of keeping it considerably in check. Contagious abortion has been the subject of research work in up-to-date laboratories all over the world, and our knowledge of the disease is slowly but surely advancing in a direction likely to lead to its ultimate eradication.

It has been suggested by farmers' organizations that legislation should be enacted to restrict the sale of cows which have recently aborted, but great difficulties present themselves in this connection. In the first place, an animal may abort without the aid of the germ of the contagious form. The majority of affected cows abort in from two to seven months after conception, yet it has been pointed out that many cows carry their calves the full period although they are harbouring the contagious germ and are still capable of spreading the disease to other animals. It will be recognized, therefore, that if such legislation were hastily adopted many great difficulties would arise and hardship occur. At the present time it would practically mean that no one could sell a cow without first having a small quantity of its blood examined by a bacteriologist. As this process is a somewhat complicated one much delay might occur, and no action could be taken against any one for exposing for sale any animal suspected of this disease without this test being applied. A simple way out of this difficulty would be to frame a clause to cover any cow which has aborted within the gestation period; but the objection to this is that it would include all abortions from whatever cause and yet, as already indicated, not absolutely prevent the sale of some animals harbouring the germ of contagious disease.

Many valuable additions to knowledge concerning contagious abortion have been made within recent years. It can now be fairly accurately determined by bacteriological examination of the blood of an animal whether it is harbouring the germ of the disease or not. It has also been determined that the contagious germ is migratory—that is, when the animal is pregnant the germs are to be found inhabiting the genital organs, and when non-pregnant they are almost exclusively found in the udder and adjacent lymphatic glands. Further, there are indications that at no great future date a perfect system of vaccination or inoculation will be found which can be practically applied in this country, but at the present time this form of prevention is not sufficiently out of the experimental stage to be of practical value under our conditions.

Here the conditions of housing and milking are very different from those of Britain, where the tests have been applied and a certain degree of success claimed. These tests, however, require careful examination regarding their results, as it is a well-known fact that in some herds contagious abortion disappears to a considerable extent without any treatment whatever, and with a herd so tested no doubt the favourable results would have been placed to the credit of inoculation. These experiments are being carefully watched and tests made at the Department's veterinary laboratory, consideration always being given to the practical side of the matter.

Another principle recently advocated, and apparently practised with success, is that of acquired immunity. Large stockowners, recognizing that any treatment whatever was almost wholly outside the sphere of practical application, went to the other extreme and decided to keep all aborting cows together and breed from them, only introducing new blood when absolutely necessary. They claim that by doing this they have considerably reduced their losses from contagious abortion, as the animals appear to become immune from the disease.

These remarks bring one to the question, What is best to be done by the farmer pending the adoption of new methods? It can be gathered from the information already acquired that the only time in which the washing-out of the genital organs of cows is of any effect is immediately after calving. Moreover, every measure for cleanliness and sanitation should be adopted, so that the contagious germ may be reduced as far as possible. After impregnation the usual sanitary methods in connection with the external parts should be continued as formerly advised. (See *Journal*, June, 1918, page 329.)

BLACKLEG.

Blackleg was probably introduced into this country through the agency of unsterilized bone manure, and made its appearance simultaneously at two points far apart, one being near Tikorangi, in Taranaki, and the other close to Auckland. The results, so far as Taranaki is concerned, are well known. In both districts the spread of blackleg was principally through the agency of the saleyards. In Taranaki the disease has been confined to a well-defined area. This success was principally due to taking in under the quarantine regulations a large area of clean country on the outskirts, and as soon as it was found that we were outside the trouble these boundaries were somewhat contracted. In the Auckland District the position is somewhat different, as it is most difficult to secure a natural boundary of any value. Fortunately, the great success of vaccination has saved the farmers large numbers of stock from this disease, and as the vaccine is prepared at the Department's laboratory at Wallaceville the expense of administration is not very great.

One very important point regarding blackleg (and anthrax) should always be kept in view, and that is that once a farm has become infected it may continue to be a danger-ground, even for a period of five or seven years afterwards. Therefore, while the farmer may for two or three years have had successful vaccination and no deaths, he should still continue to have his cattle vaccinated, so as to prevent any further disease from this cause. Unfortunately, there have been a few outbreaks where the disease had not been in existence for a year or two. In these cases, however, upon the land changing ownership

the incomers were not aware that blackleg had ever existed upon the place, with the result that some of their stock died of the disease before vaccination. The year or two for which these farms were free from disease was absolutely lost by its reintroduction, and there is no doubt in my mind that blackleg will never be stamped out upon any farm unless the utmost care is taken that no outbreaks are allowed to occur from lack of vaccination. Further, if a death occurs, not only should the animal be deeply buried, but all the surface soil contaminated by the carcase should be thrown into the bottom of the hole.

SOME OUTSIDE DISEASES : IMPORTATION PRECAUTIONS.

Anthrax, a deadly disease and one which affects all animals, was introduced into New Zealand some years ago (also through unsterilized fertilizers of animal origin), but the prompt action then adopted, and the measures taken to prevent its reintroduction has placed the Dominion in the position of having been absolutely free from this disease for the past fourteen years.

A cattle-disease which requires careful watching—not having been introduced into this Dominion—is what is known as worm nodules. This parasite affects the muscles of cattle to such an extent as to cause serious losses in the beef product.

The gad or warble fly is another pest which is carefully watched for when cattle are being introduced. As the development of the warble when the animals arrive is very uncertain, not only has the quarantine period to be enforced, but long after the animals have been discharged the owners should carefully examine them for all evidences of warbles upon the back, and not only squeeze them out when almost ripe, but see that they are destroyed. They will be reminded of this necessary attention by periodical visits from the local Inspector of Stock for some time after the cattle have reached the owner's farm.

The best strain of milking-goats which can be procured in Great Britain is shortly being imported into the Dominion by the Department and also by a private owner. The blood of each of these animals will have to be microscopically examined in quarantine, as goats suffer from a blood-parasite which is also communicable to the human subject. As far as we know, this disease has never been introduced into New Zealand. It is therefore of the utmost importance that it should be kept out. Even dogs from some countries are debarred because it is well known that they harbour a blood-parasite which is capable of being conveyed to other animals.

There are many other serious contagious diseases, such as foot-and-mouth disease, rinderpest, rabies, pleuro-pneumonia, glanders, &c., which have been kept out of the Dominion by the regulations governing the introduction of stock and by those requiring the pre-sterilization of imported animal manures. Sometimes the Department is blamed for being too strict in the administration of these regulations, especially when debarring the introduction of new blood into the Dominion from certain countries; but no new blood, however valuable, would ever compensate for the great loss and inconvenience the country would suffer should any of these highly dangerous diseases be introduced. While the Department sympathizes with breeders in their endeavour to secure fresh breeding-stock, the interests of the Dominion as a whole must have first consideration.

IMPROVEMENT OF POOR PASTURE.

THE WALLACEVILLE EXPERIMENTS.

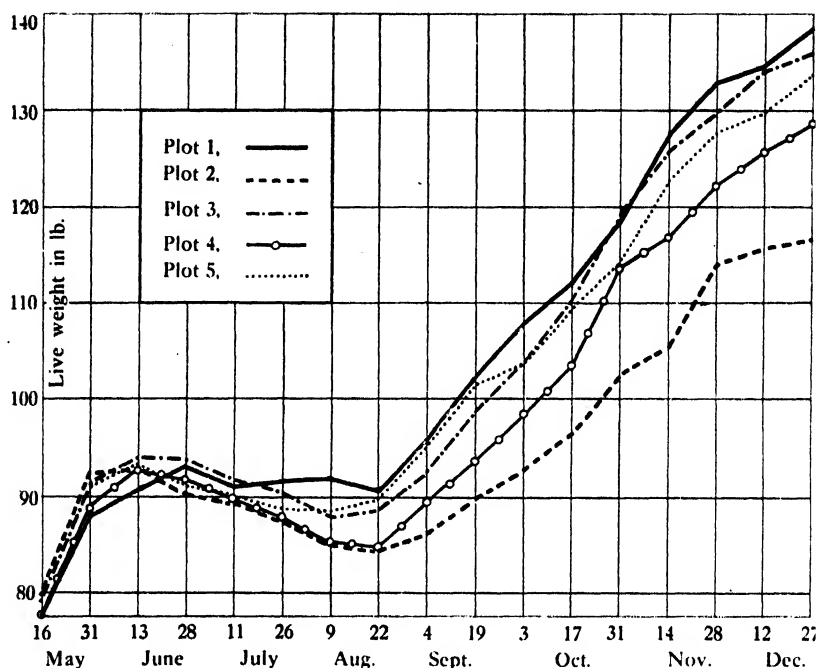
B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

IN the issue of the *Journal* for January, 1919, the writer gave the results of a series of pasture-improvement experiments at Wallaceville with poor flat "black-birch" (*Fagus Solandri*) country, a shallow soil resting on a gravel and boulder subsoil. Since Wallaceville is adjacent and has similar soil to that of the Trentham Camp, with which many thousands of New-Zealanders have been made familiar, it is not intended to recapitulate anything further concerning the soil and pasture which has been used in carrying out the experiments. It will suffice to say that the object is to determine the best method of improving poor shallow unploughed flat danthonia pasture, which naturally yields its best pasturage in wet seasons, which dries up in dry seasons and summer to a dangerous degree, and which is subject in the winter months to the severity of climate which characterizes an inland situation at the altitude of the Upper Hutt plain. Alteration in the pasture due to the treatment has been gauged by the fortnightly weighing of the animals pastured thereon, with the exception of the temporary cattle or horses, which were put on from time to time in order that the pasture might derive some of the benefits which are so well known to accrue from mixed grazing, involving the removal of rank herbage unpalatable to sheep, with the consequent replacement of more acceptable food.

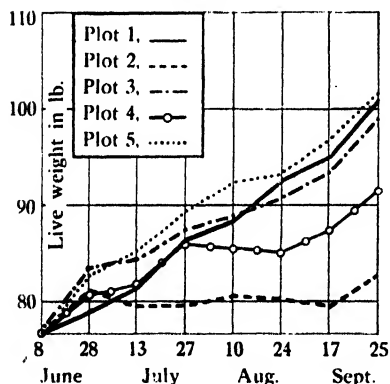
By means of efficient management* in the grazing and the judicious top-dressing with suitable substances it is hoped to improve the sward of grasses and clovers, so that the maximum grazing-capacity may be attained through the years. A somewhat significant fact was impressed on the writer by a casual observation made some months ago. On the limestone-treated paddocks a number of large stones of white limestone were spread over each paddock in 1915, and remained conspicuously visible for two or three years, owing to their colour being quite a contrast to the other stones. It is now difficult to find any of these stones, owing to the fact that they are slowly sinking out of sight. Those who care to follow the matter further as to the scientific reasons for this should consult Darwin's book on "Earthworms." Examination of the larger stones remaining showed that they are sinking at a rate which is comparable with that given by Darwin, and no doubt it is only a question of time when they will be completely covered with turf. This observation prompts the idea that the natural improvement of all flat, stony, grassed and grazed country must be much more rapid than most people imagine. The action of earthworms in bringing up castings and enabling stones to sink and the surface to become covered with soil must be improving this type of land irrespective of aid from manurial dressings of an artificial nature.

* Mr. J. Evans, Farm Overseer, has continued his valuable assistance, as in previous years, in this respect.

1919.



1920.



The quantities and dates of the different top-dressings on the five 5-acre paddocks are as follows: No. 1, 5 cwt. basic slag, applied February, 1919; No. 2, control (no treatment); No. 3, 3 tons limestone rubble and 5 cwt. Muriatic phosphate, applied 1915; No. 4, 3 tons limestone rubble, applied 1915; No. 5, 5 cwt. Ephos basic phosphate applied 1915.

The upper graph shows the fortnightly weighings of the sheep on the respective experimental paddocks from May to December, 1919. The lower graph shows similar weighings from June to September, 1920.

Ten sheep were grazed for weighing purposes on each of the five 5-acre paddocks between the dates specified, but, in addition, during the flush period in early summer extra stock were grazed on all except the control paddock. During the intervening periods—when experimental grazing and weighing were in abeyance—the areas were well stocked with sheep, cattle, and horses.

These experiments, it should be noted, are not conducted on meadows or hayfields which it is possible to plough and therefore to improve by rotation or by sowing with more nutritious grasses. The Wallaceville land is essentially pasture land, and the experiments conducted on it are therefore of a unique type.

One of the most important facts demonstrated, and one which has a peculiar interest for farmers at the present moment, is the excellent result given by ground mineral phosphate rock from Makatea Island, which is so similar in chemical composition to Nauru Island phosphate as to be practically identical with it. On one of the paddocks Makatea phosphate was used in conjunction with limestone, and although in point of fineness the phosphate was not all that could be wished* the results have been eminently satisfactory, and point to the fact that this type of high-grade mineral phosphates may be relied upon to give good results on land which responds to phosphate and which has a similar rainfall. In view of the large amounts of high-grade Nauru Island phosphate which will shortly become available for New Zealand farmers it is strongly urged that it be used for top-dressing pastures in the finely ground condition without any admixture of other fertilizers, and used in conjunction with lime if necessary. In this way nitrogen will be further accumulated in the soil by the clovers and plant residues, and thus the necessity for this most expensive ingredient in artificial fertilizers be dispensed with. There only remains potash to be considered, and the writer's advice to pastoralists is to experiment with small areas, and determine to what extent improvement may be effected by the use of this at present costly substance. With a prospect of supplies cheapening it will be better at present to confine the use of the potash salts to purely experimental areas.

The marvellous effects of basic slag on Wallaceville pasture may be briefly alluded to. A paddock (No. 1) which was dressed with an equivalent money value of finely ground carbonate of lime to the coarse unground limestone in 1915 proved to have such an inadequate amount that it was regarded merely as a duplicate control paddock. It was therefore decided to top-dress it with basic slag, which was accordingly applied at the rate of 5 cwt. per acre on 25th February, 1919. The response of the pasture was almost magical, and the beneficial results are shown on the live-weight gains which the sheep made on the slagged paddock compared with the control plot. A writer in the *Journal of the Ministry of Agriculture* (British) for May, 1920, on the use of slag had a similar experience. He states that the application of basic slag to a plot on 13th June wrought "a marvellous transformation," and adds, "It is commonly said that basic slag requires time and plenty of rainfall before any effect can be seen, but by the August weighing, eight weeks afterwards, the change in the appearance of the plot was quite evident, and all through the following two months perfectly remarkable, plenty of healthy-looking small clover herbage all over the plot. It was most interesting to observe how the sheep immediately bore witness to the improvement." Then, New Zealand readers should carefully note what at the end of the same article this

* Only 49 per cent. passing through a 100-mesh sieve and 95 per cent. passing a 30-mesh sieve, whereas the fineness of ground mineral phosphate should be at least equal to that demanded for basic slag—viz., 75-90 per cent. to pass through a sieve with 100 meshes to the linear inch (or 10,000 to the square inch).

writer states: "In rainy districts and on sour soils ground mineral phosphate is practically as good as slag." The North Island reader will not be disposed to dispute the applicability of the above terms to the climate and soil of at least those portions of the Island which are outside of Hawke's Bay.

It is not now intended to dwell further on the matter in this respect except to point to the lasting effect of phosphate and limestone dressings in these Wallaceville experiments, which have now been running for five years. The results warrant the close attention of all who have similar poor country which it is desired to render more productive. Paddocks 2, 3, and 4 are strictly comparable in all respects, but paddock 1, as has been stated, was dressed much later than the others with slag, while paddock 5, with Ephos phosphate, is rather more favourably situated than the other paddocks, as it has the advantage of some "birch" forest, which provides shelter in cold windy weather.

A further contribution will be made in a later issue of the *Journal*, in which the 1920 grazing results, which are at present in progress, will be given in full, and the whole of the results then discussed fully. In the meantime two graphs are published, representing the results in mutton-production for 1919 and part of 1920.

TESTING OF PUREBRED DAIRY COWS.

C.O.R. JERSEY LIST TO END OF SEPTEMBER.

W. M. SINGLETON, Assistant Director of the Dairy Division.

SINCE the end of the first half-year, when the last list was published, certificates have been forwarded in comparatively large numbers to testing breeders. A complete list for all breeds would be too lengthy for one issue of the *Journal*. The list for Jerseys is therefore published in this issue, and it is intended to similarly report the records for Friesians, Ayrshires, and Milking Shorthorns next month.

The present list of Jerseys contains two new class-leaders. Aster's August Child, owned and tested by Mr. James Nicolson, of Kaupokonui, constitutes a new leadership record for the junior two-year-old class, at 689.05 lb. butterfat. As a matter of fact this heifer commenced her test as a yearling, being only 1 year 337 days old at the time of calving. She displaces Mere, who was tested by Mr. F. S. McRae, of Palmerston North, and as a yearling produced 663.64 lb. butterfat. Mere's at the time was a world's record, but has since been surpassed to an extent that although Aster's August Child has beaten Mere's record the new class-leader's record does not carry a world's championship. The record of Aster's August Child, nevertheless, adds prestige to our New Zealand records in a manner that is much appreciated by all true lovers of good purebred dairy stock. Since Aster's August Child is, on the sire's side, closely related to Sultan's Daisy, the new record may be taken as to some extent substantiating that of the present

Jersey champion, and will doubtless add popularity to this particular strain of Jersey breeding.

The senior two-year-olds have produced a new class-leader in Lady Superior, owned and tested by Mr. John Hale, New Plymouth. Her record of 680.33 lb. butterfat supersedes that of Lady Peggy, owned by Mr. E. Griffiths, New Plymouth, which cow has a credit of 650 lb. The new leader is by Soumise Tom, who is a son of Soumise Majesty, and from a daughter of Dalesman. The dam of Lady Superior is Princess Maid, a granddaughter of Campanile's Sultan. Princess Maid also traces to such well-known progenitors as New Zealand's Exile, Waikato's Fancy, Monopoly II, and Silver King (Stuckey's).

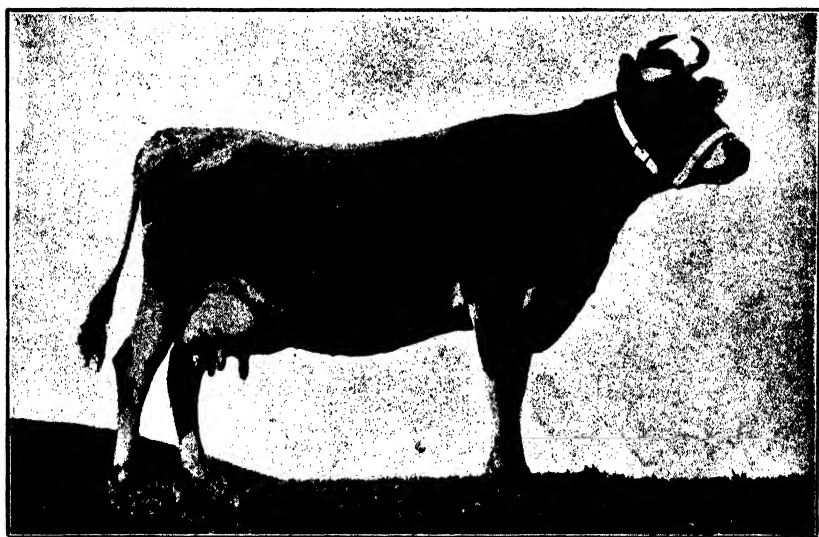


ASTER'S AUGUST CHILD.

The class for three-year-olds has two records reaching the 500-lb.-butterfat class in those of Oakland's Lassie, owned and tested by Mr. W. Anderson, Aokautere, Palmerston North, and Tiny Sylvia's Rona, owned and tested by Mr. A. E. Washer, New Plymouth. Oakland's Lassie is by Rab the Ranter, a grandson of Wild Cherry and Magnet's Lad. Her dam, Dossie, is a daughter of Señor, who is by Silver Conqueror from Senorita, a daughter of K.C.B. Senorita has two C.O.R. records, neither of which were for full time and therefore do not do her justice. Her daughter, Signorina, has a record reported in the four-year-old class of 560.11 lb. butterfat. She is owned and tested by Mr. R. F. Wilkinson, Pukekohe. Tiny Sylvia's Rona, by Sir Cuthbert from Tiny Sylvia, is an indication that a cow does not invariably require to have C.O.R. dams and granddams to enable her

to make a good record. There are doubtless many purebred cows in New Zealand that could make good records were they tested under good conditions, and thus a larger number of heavy-producing strains would be brought into prominence.

Of the eight records in the four-year-old class no less than five have credits exceeding 500 lb. butterfat, and one of these exceeds 600 lb. Fox's Lady, with a C.O.R. for 605·65 lb. butterfat, heads this list. She is a daughter of the imported Majesty's Fox, and on the dam's side is descended from such sires as K.C.B., King Thistle, and Tommy Atkins. She was tested by Mr. W. A. Guy, Matapu, and on such good grass country it was to be expected that the factors for production inherited by this cow would have an opportunity of displaying their



LADY SUPERIOR.

worth. That they have done so is evidenced by the production of Fox's Lady. Spec's Lady carries some of the same Jersey strains as Fox's Lady, she being a granddaughter of Majesty's Fox and tracing twice to K.C.B. She is owned and was tested by Mr. A. J. Harris, of Bombay, Auckland District. Other good records in this class are those of Te Mara's Zena Dare, who produced 567·79 lb. butterfat for Mr. C. A. Care, of Cambridge; Signorina, to whom reference has been made above; and Flossie Deem, who produced 548·04 lb. butterfat for Mr. T. Pollock, of Pukekohe.

The mature Jerseys in the list have many creditable records, the most outstanding being that of Dominion Lovely's Gem. This cow had been on test three times previously. She has now exceeded her best previous record by 117·66 lb. butterfat, her record commencing at the age of

9 years 249 days. She is by Yankee Sweet and from a daughter of Magnet's Lad out of a daughter of Musket. Dominion Lovely's Gem is owned and was tested by T. Pollock, of Pukekohe. Twylish's Dewdrop, owned and tested by Mr. W. Anderson, Aokautere, near Palmerston North, also reached the 500-lb.-butterfat class by a good margin. She is a daughter of Brighton Twylish from a daughter of Silver King out of a daughter of K.C.B. This daughter of K.C.B. was Queen of Flowers, a daughter of Sunflower III, who was by Dry Monopole. That Twylish's Dewdrop inherited producing factors to a very satisfactory degree cannot be doubted.

JERSEY RECORDS FROM 1ST JULY TO 30TH SEPTEMBER, 1920.

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
<i>Junior Two-year-old.</i>		<i>Yrs. dys.</i>	<i>lb.</i>		<i>lb.</i>	<i>lb.</i>
Aster's August Child	J. Nicolson, Kaupokonui	1 337	240·5	365	11,498·5	689·05
Rita's Lass	A. H. Huggett, Stratford	1 330	240·5	342	8,576·9	473·52
Bachelor's Flower	W. Luxton, Waitoa	2 40	244·5	365	7,751·5	450·17
Willow Bank Wonder	F. Ranford, Stratford	2 0	240·5	350	7,865·2	408·84
Laurel's Famous	F. Cresswell, Palmerston North	2 28	243·3	365	6,859·0	403·86
Rozel's Breeze	J. B. Clemow, Stratford	1 276	240·5	365	7,532·7	403·01
Gold Bell	C. A. Care, Cambridge	1 314	240·5	365	7,988·3	402·46
Orielton Heather Bell	B. Tripp, Timaru	2 54	245·9	300	6,581·5	367·97
Oakvale's White Patch	C. H. Weston, New Plymouth	1 350	240·5	365	7,341·1	366·76
Willow Bank Ability	F. Ranford, Stratford	2 19	242·4	317	6,867·8	366·06
Cicero's Princess	H. H. Buxton, Hawera	2 22	242·7	364	6,566·2	364·43
Laurel's Heroine	F. Cresswell, Palmerston North	1 325	240·5	317	6,644·6	363·70
Bilberry's Darling	K. Rothe, Riverlea	1 318	240·5	319	5,581·5	351·73
Belle Clare	K. Rothe, Riverlea	2 4	240·9	324	6,055·6	327·62
Pretty Primrose	A. Buchanan, Palmerston North	2 23	242·8	307	6,144·3	326·09
Dainty Hawk	T. Pollock, Pukekohe	2 52	245·7	349	6,990·6	321·04
Vixen of O.K.	G. T. Gibbons, Ngaire	1 351	240·5	341	5,681·7	312·51
Oakvale's Doris	W. Mortlock, Normanby	1 306	240·5	365	5,126·4	312·16
Belvedere Pandora	James Shaw, Paterangi	2 36	244·1	241	5,141·3	283·33
Zeal of Bull's	F. J. Watson, Bull's	2 5	241·0	347	3,987·4	267·90
Laurel's Dove	F. Cresswell, Palmerston North	1 357	240·5	298	4,888·3	254·35
<i>Senior Two-year-old.</i>						
Lady Superior	J. Hale, New Plymouth	2 183	258·8	365	9,975·5	680·33
Molina's Ripe Cream	H. T. Mellow, Stratford	2 276	268·1	298	9,545·5	496·74
Collingwood's Sweet Pea	W. R. Hayne, Timaru	2 119	252·4	365	8,515·3	485·63
St. Lambert's Bell	A. J. Smith, Cardiff	2 250	265·5	365	8,228·3	470·34
Laurel's Daisy's Sultana	F. Cresswell, Palmerston North	2 335	274·0	365	7,431·8	448·58
Brookland's Claribelle	R. P. Staples, Hamilton	2 334	273·9	365	7,718·0	406·41
Princess Ethel	W. G. Reece, Opotiki	2 296	270·1	309	6,815·5	356·02
Charm's Favourite	G. Buchanan, Paeroa	2 197	260·2	365	6,281·6	344·37
Roslyn Lady Flower	J. Harris, Bombay	2 241	264·6	359	7,177·9	334·18
Pencarrow's Triangle Queen	Mrs. C. Day, Tamahere	2 244	264·9	285	4,664·7	311·69

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
<i>Three-year-old.</i>		<i>Yrs. dys.</i>	<i>lb.</i>		<i>lb.</i>	<i>lb.</i>
Oakland's Lassie ..	W. Anderson, Aokautere	3 32	280·2	362	10,557·8	580·66
Tiny Sylvia's Rona	A. E. Washer, New Plymouth	3 168	293·8	365	9,117·5	564·76
Oakvale's Gin Gin ..	W. Mortlock, Normanby	3 11	278·1	365	9,315·5	484·23
Flora Deem ..	T. Pollock, Pukekohe	3 297	306·7	365	9,741·3	474·67
Zola ..	A. and J. O'Donnell, Inaha	3 341	311·1	344	9,372·8	472·26
Lady of Collingwood's Hope	Hellyer Estate, Dunedin	3 133	290·3	346	7,531·2	425·30
Saucy Queen ..	H. H. Phillips, Te Runga	3 225	299·5	365	8,778·8	416·97
Sunny Brae ..	T. Pollock, Pukekohe	3 150	292·0	333	6,896·6	368·29
Barbury's Princess ..	A. Hazelton, Waihou	3 47	281·7	283	6,719·9	359·51
<i>Four-year-old.</i>						
Fox's Lady ..	W. A. Guy, Matapu ..	4 332	346·7	325	11,192·7	605·65
Spec's Lady ..	A. J. Harris, Bombay	4 4	313·9	365	10,351·1	592·59
Te Mara's Zena Dare	C. A. Care, Cambridge	4 241	337·6	365	11,324·8	567·79
Signorina ..	R. F. Wilkinson, Pukekohe	4 331	348·6	365	10,477·3	560·11
Flossie Deem ..	T. Pollock, jun., Pukekohe	4 334	346·9	365	11,628·2	548·04
Maid's Pet ..	J. B. Clemow, Stratford	4 235	337·0	354	7,310·1	439·10
Pea Blossom ..	D. P. F. Malone, Kaponga	4 7	314·2	280	7,028·6	415·47
Laurel's Gipsy Queen	F. Cresswell, Palmers-ton North	4 7	314·2	320	7,320·4	373·16
<i>Mature.</i>						
Dominion Lovely's Gem	T. Pollock, Pukekohe	9 249	350·0	362	9,599·5	557·26
Twylsh's Dewdrop ..	W. Anderson, Aokautere	7 265	350·0	365	11,163·8	531·16
Waitoa ..	J. A. McCallum, Inaha	7 253	350·0	365	7,922·5	492·04
Oakleigh's Chase ..	W. Luxton, Waitoa ..	5 91	350·0	338	7,524·4	478·86
Genoa Chase ..	W. J. Hall, Matatoki ..	7 7	350·0	338	7,935·5	472·29
Floria's Gem ..	J. F. Vosper, Matamata	6 8	350·0	329	6,976·7	459·62
Mystery's Pamela ..	J. F. Vosper, Matamata	5 65	350·0	331	8,308·4	456·28
Goldlace ..	J. R. Jones, Tariki ..	5 31	350·0	338	7,504·0	452·71
Floria's Pleasure ..	J. F. Vosper, Matamata	5 299	350·0	292	8,406·9	449·96
Belle of Puketapu ..	H. R. Benbow, Ormondville	6 330	350·0	219	7,285·6	443·03
Golden Gleam ..	S. Atkinson Papatoetoe	5 240	350·0	355	7,602·6	439·78
Merry Queen ..	J. B. Clemow, Stratford	5 105	350·0	315	7,009·9	414·19
Briar Lady ..	H. H. Buxton, Hawera	5 336	350·0	287	7,155·3	358·49
Oakden Gazelle ..	E. Harding, Woodville	5 338	350·0	300	6,026·2	351·95

Lucerne and Butterfat Records.—Mr. J. W. Deem, Fields Instructor, writes, "It is interesting to note that the new C.O.R. class-leader in the Jersey two-year-olds, Mr. James Nicolson's Aster's August Child, was grazed on lucerne throughout her milking-period."

STRATFORD MODEL DAIRY FARM.

NOTES ON OPERATIONS.

J. W. DEEM, Fields Instructor and Supervisor of Subsidized Demonstration Farms.

DURING the year 1919-20 the negotiations for the purchase of the freehold of the farm were completed. The obtaining of a permanent title is a matter on which the society is to be congratulated, and future progress and improvements can now be entered upon without any fear that the property may pass into other hands. The money necessary to pay for the freehold was secured by the guarantors agreeing to an increased bank overdraft.

Improvements have been continued as fast as funds would permit, and in the three years the society has been in occupation of the farm approximately 60 acres have been stumped.

After writing off the usual amount for depreciation the sum of £283 12s. was carried to the General Fund Account, which now stands at £833 7s. The butterfat-production for the year shows an increase of 12½ per cent.

EXPERIMENTAL WORK.

This was much on the same lines as last year, but was extended to include the testing of a number of varieties of cabbage and the making of ensilage.

The spring was rather late and cold, with a rainfall below normal, while the six months January to June were very wet with abnormal rainfall. Although crops were late in starting, the moist autumn helped them along, and they were on the whole good.

As the farm has now been in operation for three years some of the average results over that period will be of interest.

Soft Turnips.

A great many varieties have been tested, but over the three years the following six have given the best average results: Early American Purple-top, 51 tons 16 cwt.; Lincolnshire Red Globe, 50 tons; Imperial Green Globe, 46 tons 6 cwt.; Purple-top Mammoth, 47 tons 7 cwt.; Red Paragon, 45 tons 12 cwt.; Hardy Green Globe, 41 tons 9 cwt. Romney Marsh and Greystone have also given good averages. The manure used throughout the period has been basic super, at the rate of 3 cwt. per acre.

Swedes.

Thirty-two varieties were tested this last year for weight and resistance to dry-rot. When weighed at the end of May these gave percentages of rot ranging from 1 to 30 per cent. They were again examined in August, when many of the varieties showed almost the whole crop affected. The least affected varieties were Vilmorin's Early Purple-top, Garton's Master and Acme, and Sutton's and Hurst's Magnum Bonum. The first-named is a white-fleshed swede, and in addition to being fairly free from rot it is greatly relished by stock, being preferred to all other varieties. It will be tested this year on a much larger scale.

The three swedes giving the best average weights on the farm for the past three years are Superlative (44 tons 14 cwt.), Best of All (40 tons 10 cwt.), and Magnum Bonum (37 tons 10 cwt.). Although Superlative has given the heaviest weight it is one of the worst for dry-rot, and where this disease is prevalent farmers would be well advised to sow a portion of their swede crop with a better keeper.

A number of manurial tests with swedes have been carried out during the past three years, and taking the standard manures used at the rate of 3 cwt. per acre, the average yields for the period have been as follows: Basic super, 38 tons 12 cwt.; bone, slag, and super, equal parts, 38 tons 10 cwt.; basic slag, 35 tons 3 cwt. Over a period of two years bone, slag, and super, equal parts, has given yields of 39 tons 10 cwt.; Ephos basic phosphate, 37 tons; Fabre Island guano, 35 tons 18 cwt.; and Surprise Island guano, 33 tons. Nitrogenous manures added to any of these phosphatic manures have not increased the crops; in fact, in most cases a decrease has been recorded.

The advantage of liberal manuring is strongly demonstrated by the fact that the average crop grown with 3 cwt. of basic super per acre is 38 tons 12 cwt., against the average for the no-manure area of 13 tons 10 cwt., or 25 tons 2 cwt. in favour of the manure.

Mangolds.

The testing of various varieties has been continued, and the following have given the best average over the three years: Prizewinner, 49 tons; Long Red, 45 tons 1 cwt.; White Sugar, 42 tons 14 cwt.; Jersey Queen, 39 tons 14 cwt. In the test to determine the value of salt, at the rate of 3 cwt. per acre, the average increase per year for the three years has been 9 tons 4 cwt. per acre in favour of the salt.

Carrots, Kales, and Cabbages.

Matchless White, White Belgian, and Magnum Bonum carrots have given the best results.

Several varieties of kale have been tested, but Buda kale grown from New-Zealand-saved seed continues to give the best results.

Twelve varieties of cabbage were tested for field purposes last season. The three best were: Sutton's Giant Drumhead, 33 tons 6 cwt. per acre; Robinson's Giant Ox, 32 tons 8 cwt.; and Cooper's Giant Drumhead, 32 tons 8 cwt. These were sown at the end of November; the cabbages were ready for feeding in April, and kept in good condition until June.

Cereals and Tares.

These were grown as special ensilage crops. When in combination at the seeding-rate of 2 bushels of the cereal to 1 of the tares or peas there was not much difference in the gross weight of the fodder. This ratio appears to give the best results in the Stratford district, averaging between 11 and 12 tons of green material per acre. Details of these crops and the making of ensilage were given in the September *Journal*.

Pasture Top-dressing.

Field 2: In this field, which was top-dressed in 1917 (see last year's report in October, 1919, *Journal*), horses have continued to show a decided liking for the slagged area. Portions of this field were closed

up last spring, and the hay cut and weighed. The basic-slag area gave 4.12 tons of green material per acre, and the Ephos phosphate area 3.82 tons.

Field 5: The cattle have continued to eat this evenly. A portion of the field was closed for hay, and gave the following weighings of green material per acre: Area 1, top-dressed with basic super, 3 cwt. per acre, 5.83 tons; area 2, top-dressed with basic slag, 4 cwt. per acre, 6.09 tons; area 3, top-dressed with Ephos phosphate, 4 cwt. per acre, 6.04 tons. All these top-dressings had been applied in August, 1917. The field was examined before the hay was cut, when no difference could be noticed on the different areas, and the weights of green material confirm this.

Field 12, bush paddock: Eight areas in this field were treated with phosphate manures in August, 1919, at the rate of 4 cwt. per acre, as follows: Plot 1, rock phosphate; plot 2, basic slag; plot 3, Ephos phosphate; plot 4, 2 parts Surprise Island phosphate, 1 part super; plot 5, Surprise Island phosphate; plot 6, control (no treatment); plot 7, 1 part carbonate of lime, 1 part rock phosphate; plot 8, 1 part burnt lime, 1 part super; plot 9, basic super. In August, 1920, plots 8 and 9 were the best, with plot 2 close up. Then came plots 3 and 4, while plots 1, 5, and 7 show little, if any, improvement over the control plot. A further reference will be made to these areas next season.

LICE ON SHEEP: A WARNING.

It is to be regretted that the infestation of sheep with lice is on the increase in many parts of the Dominion. No doubt this is due to the past war conditions, when farmers were seriously handicapped for want of labour. The co-operation of farmers is earnestly solicited in an effort to materially reduce this pest, if not to eradicate it altogether. Instructions have been given that the relevant provisions of the Stock Act are to be stringently enforced in the future, and that prosecutions will follow in every case where sheep infested by lice are exposed for sale. Close watch will be kept as far as possible by Stock Inspectors upon saleyards for this purpose. It is trusted that stockowners and dealers will take this timely warning, and also as regards the enforcement of that portion of the Act making compulsory the dipping of all longwool and crossbred sheep, whether for sale or not. There is another species of lice besides that which inhabits the body of the sheep; the former infest principally the legs and bare parts of the body. The Act applies equally to them, and the treatment for their destruction is just the same as for body-lice.

It may be here stated that, judging by the evidence of defendants in prosecution cases, it is quite evident sufficient care is commonly not taken regarding the strength of the dips used. Oxidation, dilution, and other changes take place, and, except in the case of a freshly made-up dip wholly of new material, care should be taken to test the strength of any existing solution before adding more. An ineffective dip is worse than useless, as it misleads the owner and is no sound defence if action is taken by the Department.

—A. R. Young, M.R.C.V.S., *Director of the Live-stock Division.*

TESTS IN WINTER FEEDING OF LAMBS.

T. W. LONSDALE, Manager of the Moumahaki Experimental Farm.

THE principal auxiliary crops now used for the wintering of lambs are turnips and swedes, but while these roots are probably most suitable there is not a sufficient area devoted to them to supply present requirements. With a view of gathering data regarding other suitable methods of feeding a short preliminary test was recently carried out at the Moumahaki Experimental Farm. In May last a line of white-face lambs which had not previously received artificial food was divided into four lots of twenty each, these being weighed and marked with a distinguishing brand.

Lot 1 was turned out on swedes with the main flock of lambs, and received in addition to swedes as much chaffed pea-straw as the animals could consume. This straw was fed from self-feeding bins placed in an adjoining pasture, which, however, would only be termed a run off.

Lot 2 was placed on pasture and given lucerne hay *ad lib*.

Lot 3 was put on pasture with other sheep.

Lot 4 was placed on pasture and fed ordinary hay.

Only one lamb died (this being in lot 4), but as the death occurred two days after the test commenced it could not be taken into consideration, and, in any case, it was not attributable to the respective environment.

The lambs having been sold, the test terminated on 24th July. The average weights per head at the commencement and end of the trial, together with the respective gains for each lot, were as follows :—

Lot 1 : Weight per head—25th May, 64 lb. ; 24th July, 75·6 lb.
Gain per head, 11·5 lb.

Lot 2 : Weight per head—25th May, 63·2 lb. ; 24th July, 74·3 lb.
Gain per head, 11·1 lb.

Lot 3 : Weight per head—25th May, 54·2 lb. ; 24th July, 64·4 lb.
Gain per head, 10·2 lb.

Lot 4 : Weight per head—25th May, 62·3 lb. ; 24th July, 73 lb.
Gain per head, 10·7 lb.

It will be seen that while all the lambs made ordinary winter growth there was very little difference between any of the lots. Although lot 3 was running on old pasture without any additional food, these lambs were thinly distributed as compared with the other lots. The results of this trial must not be taken as conclusive, but they point to the fact that with judicious treatment the death-rate of young sheep during their first winter can be considerably minimized. It is proposed to extend similar tests next winter season, carrying the sheep over to shearing.

The Kea Pest.—The subsidy payable by the Department of Agriculture to local bodies for the beaks of keas has been increased to 5s. each, as from 1st October.

GORE EXPERIMENTAL AREA.

OPERATIONS IN SEASON 1919-20.

W. ALEXANDER, Fields Instructor, Invercargill.

SECTION I. TEMPORARY PASTURE (PURE PLOTS).

THIS section contains an area of approximately $3\frac{1}{2}$ acres, and is divided into three equal plots. It was ploughed out of linseed stubble in August, 1919; limed with carbonate of lime (90.41 per cent.), 2 tons per acre, in October; and sown down in mid-November as follows, the whole section receiving superphosphate at the rate of $1\frac{1}{2}$ cwt. per acre: Plot 1—perennial rye-grass (germination 80 per cent.), 2 bushels seed; plot 2—Italian rye-grass (germination 89 per cent.), 2 bushels; plot 3—Western Wolths rye-grass (germination 72 per cent.), $2\frac{1}{2}$ bushels.

Each plot was fenced off independently and grazed with sheep. Weaner lambs were put on on 31st January, at which date the plots were reported on briefly as follows: Western Wolths was showing vigorous growth and already forming seed-heads. Italian rye had made a growth of about 8 in. and was looking well, but a fair amount of sorrel was showing. Perennial rye was the most backward of the three; the growth made was from 5 in. to 6 in., and sorrel was easily predominating.

The system of stocking provided for ten lambs on plot 1, ten on plot 2, and twenty on plot 3. Plot 1 carried its quota from 31st January until 11th February, on which date the plot was carefully examined, and as a result the number of lambs was doubled, twenty being put on from 11th to 19th February. The lambs had not made much impression on the grass, but the grass had made a good impression on the lambs, as they had improved greatly. The twenty lambs could have been carried safely another week, but it was considered advisable not to overdo it for a start. A fair amount of sorrel was still showing.

Plot 2 carried ten lambs from 31st January until 11th February, on which date the number was doubled, twenty being grazed there from 11th to 19th February. Even the double stocking had failed to make much impression and the grass was running to seed, so ninety-four lambs were crowded on to this acre of Italian for two days. This had the effect of clearing off a good deal of rough feed, but it was still necessary to run the mower over the area to cut down the rough growth left. The sorrel had practically all disappeared.

Plot 3 carried twenty lambs over the first period of twelve days, then the number was doubled, when it carried forty lambs for seven days. The grass was getting completely away in spite of this heavy stocking, and the lambs had improved rapidly. For two days ninety four lambs were crowded on to this plot, but they failed to clean it up, so the mower was used here also.

Two factors here stand out as worthy of notice in connection with Western Wolths rye-grass—(1) its early maturity, (2) its fattening-

qualities. To illustrate the first point, the seed was sown on 17th November, and it was stocked on 31st January, and would have been better had it been stocked a week earlier. As regards the second point, at the end of seventeen days' grazing the buyer went through and selected 55 per cent. of these lambs as prime, although when put on the Western Wolds they were ordinary weaners just off the hills.

SECTION 2. SOFT TURNIPS.

This section (about 3 acres) was devoted to a soft-turnip variety trial, the object being to test six well-known varieties against each other under three distinct factors—yield, keeping-quality, and palatability.

The land was ploughed to a depth of 8 in. in September, then limed with 2 tons per acre of carbonate of lime (90.41 per cent.) in October. The seed was sown on 15th December, and the manures used were the same all over the section—namely, superphosphate 2 cwt., plus carbonate of lime 2 cwt., per acre.

The varieties were as follows: Plot 1, Garton's Hardy Green Globe; plot 2, Garton's Mammoth Purple-top; plot 3, Garton's Lincoln Red Globe; plot 4, Garton's Purple-top Scotch; plot 5, Garton's Green-top Scotch; plot 6, Garton's Deep Golden Yellow Long-keeping.

Yield: The weighings were carried out on 9th June, with the following results per acre (roots and tops combined): Plot 1, 31.29 tons; plot 2, 32.11 tons; plot 3, 33.93 tons; plot 4, 22.84 tons; plot 5, 20.83 tons; plot 6, 19.03 tons.

Palatability: So far as this test has demonstrated palatability, from observations made on the ground I should place the several varieties in the following order of preference: (1) Deep Golden Yellow Long-keeping; (2) Hardy Green Globe; (3) Green-top Scotch; (4) Purple-top Scotch; (5) Lincoln Red Globe; (6) Mammoth Purple-top.

Keeping-qualities: These were tested by reserving a narrow strip, 6 ft. wide, off the end of each plot. This reserved area was examined carefully on 18th August, and the following recorded:—

Hardy Green Globe: Badly affected with dry-rot at a late stage in their growth. The bulbs were not seriously damaged, as the infection had not gone further than the characteristic brown surface spots. Several bulbs were running to seed, and the bulbs generally becoming pithy; they must have lost considerably from the nutritive point of view.

Mammoth Purple-top: Considerably affected with dry-rot, but it had not gone deeper than surface spots. A number of bulbs had gone badly with soft rotting. The crop was going to seed badly, and the bulbs were quite pithy. This plot was really past being of any value.

Lincoln Red Globe: The whole plot had gone away to seed, and the bulbs were quite hollow. Dry-rot spots were also very numerous.

Purple-top Scotch: This plot continued to look well and was quite free from dry-rot. A few bulbs were beginning to show signs of soft rotting, but the majority were still sound and crisp.

Green-top Scotch: The crop was still quite sound-looking and apparently free from disease. Several bulbs, however, were developing pithy centres, indicating that they would not stand much longer.

Deep Golden Yellow Long-keeping : Fairly sound condition and free from disease. Bulbs, when cut, showed a tendency to become pithy, but might be considered to be still fair feed.

A comparison of representative bulbs from each of the six plots placed them in order of keeping-quality thus: Purple-top Scotch, Deep Golden Yellow Long-keeping, Green-top Scotch, Hardy Green Globe, Mammoth Purple-top, Lincoln Red Globe.

The value of the entire crop in this section may be summed up by reference to the amount of grazing the roots actually stood, based on the following particulars : 600 hoggets were put on on 11th June and were taken off on 14th June. Two hundred and eighty wethers were put on on 14th June (having replaced the hoggets) and kept there until 20th June, when the number was reduced to 130, and this latter number was left until 2nd July. Working on this basis, and calculating the period for which turnips would normally be required at eighteen weeks, it is found the crop would carry fifteen sheep per acre for the season.

SECTION 3. SWEDE DRY-ROT INVESTIGATION.

This special investigation is being dealt with separately.

SECTION 4. OAT VARIETY TRIALS FOR YIELD.

This section, approximately $3\frac{1}{4}$ acres, was ploughed to a depth of 8 in. in September, and then prepared for oats. The previous year's crop had been soft turnips, which were grazed off. Owing to a particularly late season, sowing of oats was not carried out until 25th October. The section was measured off into three equal plots and sown, together with basic super at 3 cwt. per acre in each case, as follows :—

Plot 1, Black Tartars, $3\frac{1}{2}$ bushels seed ; plot 2, Gartons, 4 bushels ; plot 3, Duns, $3\frac{1}{2}$ bushels.

Each of the three plots came away well, and continued to do well until harvested for chaff in February. The crops were stacked separately and remained in stack until 1st July, when they were cut into chaff, with the following yields : Plot 1, Black Tartars, 4 tons ; plot 2, Gartons, 3 tons 15 cwt. ; plot 3, Duns, 3 tons 16 cwt. ; or a total of 11 tons 11 cwt. from the area of $3\frac{1}{4}$ acres.

SECTION 5. MANGOLDS, POTATOES, AND SWEDES.

Mangolds : The mangold varieties were sown at the request of some members of the Gore Agricultural Committee, who apparently were anxious to see this crop tried out. The results have been somewhat disappointing, and are certainly not a recommendation for mangolds in the South. The germination was good, but the subsequent growth was very poor—so much so that no weights were actually taken. Further trials may be conducted in 1920-21, based on the experience of the past season.

Swedes : This consisted simply of a trial of Garton's Master variety. A plot sown on 28th November with 3 cwt. super, plus 1 cwt. carbonate of lime, produced a yield at the rate of 30 tons 11 cwt. per acre.

Potatoes (main crop) : Three varieties—Sutton's Supreme, Up-to-Date, and Northern Star—were grown, the manurial treatment being the same in each case—namely, super 3 cwt., wood-ashes 2 cwt., and

sulphate of ammonia $1\frac{1}{2}$ cwt. per acre. Unfortunately, accurate weights could not be taken, our scales being out of commission at the time, but the yields, in sacks, worked out as follows, and afford some comparative data when taken in conjunction with the area in rows as shown:—

Variety.	Number of Rows.	Table.	Seed.	Small.	Total.
Sutton's Supreme ..	25	9	6	4	19
Up-to-Date ..	26	18	8	6	32
Northern Star ..	29	22	8	8	38

SECTION 6. PERMANENT PASTURE (IN PLOTS).

This section was well cultivated prior to being sown in permanent plots in November. The land was limed with carbonate of lime (90·41 per cent.) at the rate of 2 tons per acre.

The plots are as follows: Plot 1, cocksfoot (germination 84 per cent.), 20 lb. per acre; plot 2, timothy (germination 96 per cent.), 15 lb. per acre; plot 3, prairie-grass, 56 lb. per acre; plot 4, crested dogstail (germination 95 per cent.), 15 lb. per acre.

The manurial treatment was the same all over—namely, $1\frac{1}{2}$ cwt. superphosphate per acre, broadcasted by means of the manure drill. The growth has been good, and the grass has been kept down by mowing or sheep-grazing.

SECTION 7. PERMANENT PASTURE SOWN DOWN IN 1918-19 SEASON.

The grass-mixture used in this section of 4 acres is as follows: Italian rye-grass, 6 lb.; perennial rye-grass, 10 lb.; cocksfoot, 8 lb.; timothy, 4 lb.; meadow-fescue, 5 lb.; meadow-foxtail, 3 lb.; crested dogstail, 2 lb.; *Poa trivialis*, 2 lb.; alsike, 2 lb.; cow-grass, 2 lb.; white clover, 2 lb.; total, 46 lb. per acre.

The area was cut for hay on 9th January, 8 tons being secured. Subsequent to the hay crop the 4 acres carried 100 lambs for fourteen days—27th February to 11th March, inclusive.

SECTION 8. ORIGIN OF SEED-OAT TRIALS FOR YIELD.

The object of this test was to try out, under similar conditions, several varieties of oats drawn from various localities to ascertain the influence of locality on yield. Each of the eight plots was sown on 27th October with 2 cwt. super per acre, the seeding being at the rate of $3\frac{1}{2}$ bushels per acre. The details are as follows:—

Plot.	Variety.	Locality grown.	Yield per Acre (Firsts only).
1 ..	Guyra	Australian	35
2 ..	Lachlan	Australian	37
3 ..	Duns	Springburn	60·7
4 ..	Gartons	Ashburton	85
5 ..	Duns	Kelso	62
6 ..	Gartons	Lumsden	75
7 ..	Gartons	Balfour	55
8 ..	Duns	Crown Terrace	43·2

The test did not really give either of the Australian varieties a good chance, as these plots ripened very early and fed all the small birds in the vicinity. It may be taken as certain that 20 per cent. of the grain was eaten out by the birds. In all cases the sample of grain threshed was very good, and the trial generally afforded quite an interesting test of the effect of locality.

ANALYSES OF SUGAR-BEETS.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

THE following table gives particulars of the analyses, in the Chemical Laboratory, of sugar-beets grown last season at several of the experimental farms and areas. The variety in each case was Klein's Wanzleben.

Laboratory No.	Locality.	Average Weight of Roots.	Dry Matter.	Sugar.	Purity Coefficient.	Mean Percentage of Sugar.
		lb. oz.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
M/237	Waimate West ..	4 8	20.70	12.84	87.6	13.46
		3 6		13.16		
		2 6		13.70		
		1 5		13.80		
M/238	Stratford ..	4 12	21.20	13.44	88.3	13.50
		3 8		13.60		
		2 5		13.56		
		1 7		13.20		
M/239	Marton ..	4 10	20.90	14.12	88.6	15.32
		3 6		14.86		
		2 6		15.10		
		1 10		15.26		
M/472	Ashburton ..	5 6	21.50	14.62	89.2	15.98
		4 3		15.86		
		3 6		16.20		
		2 9		15.74		
M/473	Weraroa ..	5 4	21.30	14.04	89.0	14.74
		4 10		14.30		
		3 9		15.06		
		2 5		14.82		

NOTES ON THE CROPS.

M/237: Sown 25/10/19; weighed 1/6/20. The plot was manured with superphosphate, bone, and Ephos phosphate, equal parts, at the rate of 4 cwt. per acre. Yield per acre, 26 tons 7 cwt. 16 lb.

M/238: Sown 12/11/19; weighed 2/6/20. Manure used, basic super at 4 cwt. per acre. Yield per acre, 16 tons 14 cwt. 32 lb.

Both of the above crops made heavy top-growth; but in both cases the roots were very uneven in size and of only fair quality.

M/239: First sown 17/10/19, with 6 cwt. per acre of mangold-manure; but as the germination was bad and the plants that did come

were smothered with spurrey the ground was again worked up, and a second sowing made on 24/11/19, with 2 cwt per acre of basic super. This crop was again hampered with spurrey, and only a small area was saved. The roots were uneven in size and shape, and there was a heavy top-growth. Weighed 10/6/20; yield per acre, 22 tons 10 cwt.

M/472: Sown 16/10/19, with superphosphate at $1\frac{1}{2}$ cwt. per acre. The beets were lifted in June, and yielded 18.75 tons per acre.

M/473: Sown in November, 1919, on heavy loam, following on a pea crop. The manure used was 5 cwt. salt, $\frac{3}{4}$ cwt. sulphate of ammonia, 3 cwt. superphosphate, and wood-ashes equivalent to 1 cwt of potash (1 ton), per acre. The crop was harvested in June, 1920, and yielded 24 tons 10 cwt. per acre.

In the case of both M/472 and M/473 the roots were mostly large and well formed.

Illustration of Hemlock.—By the omission of a word in the title-matter of the drawing of hemlock published in last month's *Journal* (p. 117) figures A to D were described as natural size instead of *half* natural size.

Weraroa Sale of Pedigree Cattle.—The sale of pedigree cattle at the Central Development Farm on 7th October attracted a large number of buyers, and bidding was brisk. The Friesian bulls (five lots) averaged £48 18s. 7d., the highest price paid being for Dominion Woodcrest of Weraroa, at 72 guineas; the Friesian females (thirty-three lots) made an average of £62 9s. 2d., top price being for Dominion Sadie Vale, with 105 guineas. The Red Poll bulls (three lots) averaged £59 17s., the highest figure being secured for Dominion Mount Holdsworth, at 101 guineas. The sale receipts totalled £2,485 7s.

Dry-rot Fungus of Swedes.—Mr. A. H. Cockayne, Biologist, who visited the United States last year, makes the following remarks on this subject in his annual report for 1919-20: Much valuable information on the control of cabbage *Phoma* was secured in Wisconsin, where infected seed has been shown to be the main method of spread. From experiments conducted here, however, it appears conclusive that the swede dry-rot fungus (*Phoma napo-brassicæ* Rost.) is a soil saprophyte capable of living in the ground for several years. Nevertheless its appearance from time to time in crops grown on virgin land indicates that the sowing of infected seed is a factor in its dissemination. From the preliminary experimental work carried out it has been shown that the application of large quantities of water-soluble phosphates increases the disease considerably, and that potash manures have a depressing effect on the development of the fungus. Much work of a fundamental nature remains to be done before practical methods of control can be laid down.

WORK FOR THE COMING MONTH.

THE ORCHARD.

ALTHOUGH the final details relative to last season's export shipments have not been completed, a general settlement has practically been made based on prices which cannot be considered otherwise than highly satisfactory. In consequence of this the coming season's transactions are likely to be taken with a considerable amount of increased confidence, resulting, no doubt, in a very much increased supply of fruit being available for export.

Up to the present the shipping authorities have been asked to reserve the refrigerated space equivalent to a hundred thousand cases, but it is quite possible that a further fifty thousand will be asked for. In the meantime, until the pencilling-in of space—which I understand is being actively pushed on, in the Nelson District at least—has been completed it is impossible to anything like accurately estimate the amount of space required.

Further, in connection with the coming season's export, it is of interest to note the progress that is being made in the Nelson District, which district for many reasons is destined to play a leading part in any export trade which may build up in the future. The growers of Nelson have formed what is known as the Nelson Provincial Fruitgrowers' Council. This organization, which is designed to work in co-operation with the New Zealand Fruitgrowers' Federation, having been appointed "district agent" for that body, is, apart from organizing the growers of the district generally, devoting its efforts primarily toward the effective systematic control of export fruit from the Nelson District. Other movements are afoot among the growers of Nelson. Several new packing associations have sprung up, and are now actively endeavouring to establish packing-facilities in readiness for the handling of the coming season's crop. These and other activities in that district suggest that the growers of Nelson fully appreciate the effect that a successful export trade will have on the future of their industry, and it is to be hoped that their present endeavours will continue until that success is assured. —J. A. Campbell, Assistant Director of the Horticulture Division.

AUCKLAND.

Fire-blight: On account of the outbreak in the Waikato and the possibility of a further infection in or near the larger commercial areas, every orchardist is asked to use all means in his power to identify any occurrence of this disease in his particular locality. Any suspicious symptoms should be immediately reported to the Orchard Instructor in charge at the Auckland office, in order that steps may be taken to prevent a further spread. As it has now been definitely established that *Cytospora* plants (hawthorn, whitethorn, &c.) carry the disease over from one season to another in this country, this particular family may be looked upon as our chief source of infection. In several of the larger commercial areas in the Auckland District there is, happily, but a very small amount of hawthorn at present in existence, and as a preventive measure every orchardist is asked to destroy, by grubbing out and burning, any such hedges which may be on his property. By doing this he is protecting not only himself, but every other orchardist in the immediate vicinity. This disease is not at present by any means established in the commercial areas, and it is much more desirable to use preventive measures now, rather than wait and then have to apply the only cure—i.e., destruction of infected plants and trees.

Spraying: The chief operations will be those for the control of eating-insects, and also for brown-rot of stone-fruits and black-spot of pip-fruits. The spraying programme for the month may be summarized as follows: Apple, pear, and quince—bordeaux, 3-4-40, when fruit set; bordeaux, 2-3-40, or commercial

lime-sulphur, 1-100 (33° Beaumé), three weeks later, in combination with arsenate-of-lead paste, $1\frac{1}{2}$ lb., or powder, $\frac{1}{2}$ lb., to 50 gallons water. Peach, nectarine and plum—commercial lime-sulphur, 1-125, or self-boiled lime-sulphur, 8-8-50, one month after fruit-set. Citrus fruits—bordeaux, 4-4-40, when blossom-petals fall during the spring flowering, followed by red oil, 1-40, about fourteen days after.

Citrus-growers are advised where frosts have affected the growth, killing it back, to cut away all frosted parts to a bud. Failure to do this may bring on gummosis, and leave effective opportunities for the entry of borer.

Ploughing operations must now be completed, followed by the very necessary undertaking of working down the soil into a good tilth, before the dry weather sets in. With the ever-rising cost of labour the commercial orchardist will be on the lookout for every possible means of saving labour, and the procuration of all labour-saving implements. Wherever possible, ploughing up as close to the trunk of the tree without damaging the feeding-roots, by means of the bridle on the plough, should be undertaken.

Thinning is a most important operation, and as soon as it can be seen that the fruit is properly set this work should be carried out on apples and pears. With stone-fruits it is necessary to wait until after stoning.

The disbudding of young trees (two to three years old) must be attended to, rubbing out the buds low down on the trunk, and leaving only sufficient buds for the formation of the main arms of the tree.

Growers are reminded that the regulations controlling the sale of locally grown fruit and the branding of cases are now in force, and this should be borne in mind when ordering new cases.

—J. W. Collard, Orchard Instructor, Auckland.

HAWKE'S BAY.

Attention should be given to cultivation, working the surface soil to a fine tilth, thus retaining moisture and destroying weeds.

Young trees should be looked over and all superfluous growth removed; the best result is obtained by removing such when they can be pinched out. Undesirable growths should also be removed from older trees; these growths frequently occur where a large limb has been removed, and choke up the inner part of the tree if not cut out.

Should this season's setting of fruit be up to blossom-indication, thinning will have to be undertaken in most instances to ensure a good class of fruit.

Spraying for the month will be as follows:—Codlin-moth: Arsenate of lead, $1\frac{1}{2}$ lb. paste or 1 lb. powder to 50 gallons water. Black-spot: Apples—lime-sulphur, 1-100; pears—lime-sulphur, 1-80; should black-spot show up, use bordeaux, 3-4-40. Powdery mildew: Lime-sulphur, 1-100, or atomic sulphur, 1 lb. to 10 gallons. Leach on plums: Arsenate of lead, 1 lb. paste or $\frac{1}{2}$ lb. powder to 50 gallons water. Red mite: Continue applications of lime-sulphur, 1-100, at eight-day intervals while mite is present. Lime-sulphur may be applied with arsenate of lead, but fresh lime, equal weight to arsenate, should be added to safeguard against spray damage.

—W. H. Rice, Orchard Instructor, Hastings.

NELSON.

The practice of spraying stone-fruit soon after setting with lime-sulphur, 1-120, plus the milk from 6 lb. of lime, for the prevention of brown-rot has given very encouraging results, and it is recommended for the present season. The same mixture (rather stronger, say, 1-100) should be applied to apples and pears as soon as they have set. To it should be added arsenate-of-lead paste, 3 lb., or half that quantity of powder. Where there is difficulty in controlling black-spot it is customary to make another application of bordeaux with arsenate of lead in place of the above.

Trees should be carefully watched at this period and prompt steps taken to deal with undesirable developments. Leaf-hopper, for instance, will probably be troublesome in some sections. Trees so infected should have Blackleaf 40, 1 pint, added to the 100 gallons of lime-sulphur mentioned above. These sprays applied at this period are spoken of as calyx-sprays, and should be repeated after an interval of about three weeks or a month.

Trees sometimes set a larger crop than they can mature or even carry. The capacity of a tree should not be strained; superfluous fruit must be thinned off without delay, taking care to remove all fruit from the tops of the leaders.

The weaker trees in the orchard require a good deal of attention of this kind; small dressings of nitrate given to such trees at this time will be of great assistance.

It will be now some two months since the spring ploughing, and vegetation turned in will have decayed. A second ploughing would be advantageous, across the last if possible. Follow this operation promptly with the harrows.

Young trees and those that have been regrafted will have now made numerous growths of a few inches in length. Stop those that are superfluous by pinching out the growing point; by this means the shape and economy of the tree is much enhanced.

The operation of grafting may still be performed if suitable scion wood can be obtained.

—W. C. Hyde, Orchard Instructor, Nelson.

MOTUEKA.

The thinning of fruit may be undertaken about this stage. Remove malformed and diseased fruit when performing this operation; the results will repay the trouble taken where crops are heavy. The production of "cull" fruits should be avoided where possible, as they only increase the cost of handling, &c., and decrease net returns per case.

Cultivation should be attended to and the soil kept in good tilth for the coming hot weather.

Spraying measures will consist of the usual application of arsenate of lead, $1\frac{1}{2}$ lb. paste or $\frac{3}{4}$ lb. powder to 50 gallons water, to be applied about every third week. This will serve to control codlin-moth on pip-fruit. The same spray applied to cherries and plums when pear-slug makes its appearance will have the effect of keeping this pernicious insect under control.

Lime-sulphur should be used at this stage for control of fungus diseases and red mite, at the following strengths: Pears, 1-80 to 1-100; apples, 1-100 to 1-120; stone-fruits, 1-125. —W. T. Goodwin, Orchard Instructor, Motueka.

CANTERBURY.

With the appearance of these notes summer work will have commenced in the orchard, and growers will be estimating their crops. The trees will be in full leaf, and consequently care must be exercised with the spraying, remembering that healthy foliage is necessary in order to obtain the best results. The chief trouble in this district will be black-spot, especially if the weather is at all favourable for the development of the spores. Lime-sulphur, 1-100 to 1-120, should prove effective in checking the spot on apples, and bordeaux, 3-4-40, on pears. The necessity for testing the different sprays, and the thorough cleansing of spray-pump and tank, have been dealt with previously. Powdery mildew may be noticed on the growing tips of the shoots, and, as recommended in last month's notes, should be cut out and burnt where possible, spraying the tree with lime-sulphur 1-100, or atomic sulphur, 8 lb. to 100 gallons water. Woolly aphis can be kept in check with Blackleaf 40, 1-1,000, using plenty of force to drive the spray well in to the colonies. Applications of arsenate of lead should be given for the control of codlin-moth, leaf-roller, pear-slug, &c.

Thinning is an important operation very much neglected. Where it has been done growers have noticed the difference with regard to size, quality, disease, and the health of the tree generally. All top fruit on young trees should be removed, giving the trees every chance to develop and form a good framework.

Disbudding work applies particularly to young trees planted this season, taking out all unnecessary growths, thus diverting the sap where required for the building-up of the tree.

Pay all attention to cultivation by constantly stirring the soil with the cultivator or harrows, thus retaining the moisture and suppressing the weeds.

—G. Stratford, Orchard Instructor, Christchurch.

OTAGO.

Now that the fruit is once more on the trees vigilance should be the watch-word. It has been truly said the grading of fruit should commence as soon as the fruit is set. By care and attention to cultivation, manuring, spraying, and thinning of fruit the maximum of success will be obtained. Aim to produce the best quality possible, especially in stone-fruits. It is quite probable the demand for poor-quality fruit for jam will not be great, owing to the high price and short supply of sugar. With indications of heavy crops it is desirable to thin carefully and procure good-quality fruit suitable for dessert purposes.

Follow up the spraying indicated in last month's notes, reducing the lime-sulphur spray to 1-120 as the weather gets hotter, or atomic sulphur at 8 lb. to 10 lb. to 100 gallons.

Pay attention to newly planted trees by removing surplus shoots, retaining those best situated to form well-shaped trees. Also give attention to regrafted trees, removing the shoots from the stocks to allow the scions every chance to start into good growth. Remove all fruit from the previous season's growth on young apple-trees, as the leading shoots become weak and misshapen if this is not done.

—J. H. Thorp, Orchard Instructor, Dunedin.

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

HATCHING AND REARING OF DUCKLINGS.

ALTHOUGH the correct season for hatching out chickens has now passed—that is to say, if they are to grow to a desired size and prove long-season layers of good-sized eggs—there is yet time to bring out ducklings of the laying-type, as these can be hatched and reared to advantage much later than chickens. Nevertheless, if only payable stock are to be raised there must be no delay in getting the full complement of young birds hatched out.

Where incubators are used duck-eggs require much the same treatment as hen-eggs, except in the case of applying moisture. After the fourteenth day the eggs should be well sprayed with water at a temperature of about 103° F. This may be applied with the mouth or a fine florist's spray. Do this after the eggs have been turned, and at once place the eggs back in the machine. They should not be cooled after the spraying. Spray in the morning and cool at night. This process should be repeated daily after the fourteenth day up to pipping-time. The ventilation-vents should be partly open, so that any excess of moisture not required by the eggs can get away. Never open the incubator and attempt to help the young birds out of the shell unless they have been given their full time to hatch. If the right degree of heat is maintained in the incubators—namely, 102° for the first week, and then 103° on to the pipping-time, and 104° when hatching—the ducklings will commence to pip on the twenty-sixth day and will hatch out about two days later. Therefore if the eggs "hang fire" after they have pipped, this need not necessarily cause anxiety regarding the result of the hatch. If any of the young birds fail to come out after the due hatching-time a good plan is to take a piece of thin flannel or blanket the size of the egg-tray, dipped in hot water and wrung lightly, and place this over the tray. This will have the effect of softening the membrane next to the shell and assisting the duckling to get out of its prison. If the flannel is sufficiently thin the ducklings will have no difficulty in hatching out under it.

For brooding ducklings both the heated and fireless brooder are suitable, providing of course they are of a desirable make. Whatever system is used care must be taken that an ample supply of fresh air is available to the young birds at all times. Fresh air is an important essential from the time when a duckling leaves the shell right through all stages of its development, and if there is neglect to provide this, trouble may surely be anticipated. On no account compel ducklings to sleep on damp or wet bedding, as this is a common cause of leg-weakness during the brooder stage. The drinking-vessels should be placed well away from the sleeping-compartment, as this will lessen the risk of the bedding-material becoming in a wet condition.

Ducklings require no food for at least thirty-six hours after they are hatched. During the first week the food may consist of equal parts of scalded bran and pollard mixed with a small quantity of oatmeal, to which some fine grit should be added. Feed four times a day as much as the birds will pick up clean in a few minutes. After a week the grit need not be mixed with the food, but it should always be available to them in a receptacle, so that they can help themselves. After the first few days finely cut green stuff should be fed daily, and increased by degrees as the ducklings grow older. A little boiled mincemeat may be introduced to the ration by degrees as the young birds develop. From then on an ordinary mash made up of pollard, bran, gristed grains, &c., should be provided.

Never allow ducklings water to drink, after having had a long fast, until they have received a meal, or the mortality is apt to be great as a consequence. Water

should be given with the first meal, and from then onwards it should be left in reach of the birds both day and night. This is not to imply that the water-vessel should be left in the brooder-box (except perhaps for the first day), but rather that the ducklings should have access to the brooder-run at all times, where the water-vessel should be placed. It is not uncommon where ducklings have been confined in a brooder by night without water, and are given a drink before receiving their morning meal, for them to immediately fall over like ninepins.

Shade is another matter that must not be overlooked, for with ducklings hatched in hot summer weather sunstroke is a common source of loss. Ducklings should be well protected from their natural enemies, such as rats, stoats, weasels, &c., until they are about three-parts grown, otherwise they are apt to be killed by these pests.

OVARIAN TROUBLES.

This is the time of the year that ovarian troubles, such as protrusion of the oviduct, &c., are most common. This condition is usually due to overstimulation of the egg-forming organs by providing too much forcing-food, such as meat, milk, &c. These foods are specially demanded by the laying-bird during the winter months when called upon to produce her artificial product. In fact, at that time a good egg-yield cannot be obtained unless a fair amount of a forcing diet is included in the ration. In the spring and summer months, however, at what might be termed the natural laying season for bird-life, it is entirely different, for the good layer will give a heavy yield of eggs on a much plainer ration. It is therefore imperative that any forcing-material be provided with great caution at this particular period of the year. It is true that milk is a valuable drink for fowls, and a food as well, but there should be a limit to the quantity provided during hot weather, for not only is it apt to bring on ovarian trouble, but scouring and the production of double-yolked and shell-less eggs as well. The most common mistake made is to compel the laying-birds to drink a large quantity of milk merely for the purpose of quenching their thirst. Water in addition to the milk should always be available, so that the bird is not forced in order to secure a drink to take more of the latter than is good for it. Where milk is provided in large quantities for the birds to drink the risk of the troubles in question making their appearance will be considerably minimized if water is provided in a separate receptacle. Of course, there is nothing better than milk for growing stock, but with growing pullets, if given in too large a quantity, it is apt to promote egg-laying at too early an age. Where it is found that the birds are showing evidence of prematurity the milk should be sparingly used, or, better still, cut out of the ration.

FIGHTING VERMIN.

Now that the warmer weather is at hand vermin will commence to give trouble, and unless precautions are taken for cleanliness and keeping these parasites at bay the developing stock in particular will suffer as a consequence.

THE APIARY.

G. V. WESTBROOKE, Apiary Instructor.

QUEEN-REARING.

WHILE many honey-producers consider it more profitable to purchase all the queens they need from a reliable breeder, yet there are times and circumstances which make it advisable for all apiarists to be able to raise queens when needed. In the case of a beginner who wishes to learn all he can about bee-keeping it is advisable to purchase a good breeding-queen and try his hand at rearing queens.

The first essential, then, is to have a choice purebred queen from which to restock the apiary, and as it is generally conceded that the purebred Italians are the best race to rear it will be advisable to breed such. The characteristics desirable in a good queen are that she should be purely bred and mated, her stock good honey-gatherers and docile, and as far as possible non-swarmer. The only reliable method to ascertain if the queen is purely mated is to carefully observe the young bees that have recently been hatched, and if they show even marking throughout it may be considered the queen is purely mated.

The next essential in queen rearing is to have a strong colony, with an abundance of young bees—a two-story hive for preference. A good system for the

beginner is what is called in New Zealand the Stewart method. The advantage claimed for this is that the queens are raised from natural cells. The method is as follows: During a good honey-flow find a strong two-story hive, hunt up the queen, and place her with two frames of brood in the top story over a queen-excluder; fill up with empty combs, when available, or full sheets of foundation. Three days later place a nice clean comb into the centre of the brood-nest of the breeder queen, so that she will commence to lay in it at once. Five days later this comb should be well filled with one-day-old larvæ. Then go to the prepared hive and remove the top box containing the queen, and place it on a new stand in another part of the apiary. Next carefully go through the bottom box and remove any queen-cells that may have been started. This is most important.

The prepared hive should now be hopelessly queenless, as any eggs laid by the queen prior to her being placed in the top box will have hatched and would be too old for the bees to raise a queen from. Now take away the frame of choice larvæ from the breeder queen and cut away the bottom of the comb saw-fashion, so as to leave ample room for the queen-cells—taking care that it is done in the warm part of the day, so that the young larvæ may not be chilled. Then place this frame in the centre of the brood-nest of the queenless colony. The bees will immediately commence raising cells on this prepared frame. Ten days afterwards it may be examined to ascertain how cells have been built. These should now be carefully cut out and one each placed in a nucleus hive. The latter should have been prepared a few hours previously by taking the frames of emerging bees, with adhering bees, and placing them in small nucleus hives. Or another good plan is to break up into nucleus colonies the hive that has raised the queen-cells, by putting two frames of bees and brood into nucleus hives and spreading them fan-shaped on the old situation, leaving all the entrances facing the same way as the parent hive. Then remove the now empty hive and give each small nucleus a queen-cell.

In cutting out the queen-cells care must be taken to cut well into the comb, so as not to disturb the base of the cell. These cells may be placed in cell-protectors and fastened to the centre of the centre comb. The cell-protector is not essential when utilizing the queen-rearing colony for nuclei, as the bees are used to the cells and will rarely tear them down, but if introducing the queen-cells to a queenless colony it is safer to use the protectors.

When the young queens are mated and laying—which should be in about ten days' time from hatching—they may be introduced to any colony desired, provided the queen of such colony is first removed and any queen-cells that have been started have been destroyed.

Another system of queen-rearing often adopted is the Doolittle method, which necessitates the removal of the young larvæ from the cells and grafting them carefully into prepared cups. This requires great care in handling, but large quantities of queens can be raised by this method. The latter is fully described in all text-books dealing with queen-rearing, but is not recommended for the beginner.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

TOMATOES: The first week in November is the best time to plant in nearly all places, the exceptions being extra warm localities where there is no frost. It is a great mistake to plant too early. The plants cannot make growth until the soil becomes warm and continues so. It is better to keep the plants in the boxes in a sheltered position until favourable conditions obtain than to plant when they can make no growth to speak of and are liable to severe checks from frost or cold snaps. While in the boxes the plants improve. They may make but little top growth, but the plants will be hardening and roots increasing, so that when they are planted out the plants are tough and hardy and well rooted. I am presuming that the plants have been raised at the proper time, not rushed along in a hurry; such plants are not worth having. There are a number of ways of training, and also a system where there is no training at all. Space will not allow details of the various plans, nor is it at present necessary. The actual planting and growing of the plants is the same in all cases. The main thing to aim at is a hardy and

strong plant to begin with, and then to continue in a direction that will maintain it in the same state. In some places highly favourable to tomato-culture there is always danger from late frosts, these not uncommonly occurring well into November. To my personal knowledge many extensive plantings have been lost in this way, and the losses could have been avoided. The plants were too soft when put out. That these losses were avoidable was proved by the fact that other large plantings subject to the same frost and the same exposure escaped uninjured. At some future time it may be well to explain this matter more fully; at present it must suffice to say that the plants should be of the description previously mentioned, and that they must not be watered when set out—any one with a superficial knowledge of plant physiology will know why. Apart from that, the plants establish themselves in a shorter time if not watered. When planting brush aside the dry surface-crumbs of soil, make a hole with a trowel deep enough to let the plant down to the first pair of rough leaves, return the soil, and press it firmly around the ball of roots. Evaporation from the leaves will cause the plants to droop under hot sunshine for three or four days. They will pick up each night, and after that will droop no more, but start at once into free growth. Before being planted out the plants should be sprayed with 4-4-40 bordeaux mixture. Washing-soda may be used in place of lime: in which case use rather more than 1½ lb. of soda in place of 1 lb. of lime.

Broccoli: A start with sowing should have been made before now; at the present time all varieties may be sown; it is possible to get small heads by sowing much later. Experience shows that an early start is best, as in dry summers the diamond-back moth is so serious a pest as to make it impossible in many cases to save the plants unless they are well grown before it appears.

Carrots and Parsnips: The main crops should be sown during the first week of the month. Good free-working soil is necessary, but not of an overrich character. No fresh animal manure should be applied. Superphosphate may be used if necessary; about 2 oz. per square yard should be sufficient. Land that was well manured for another crop the previous season will require no addition. During the early part of the season when rain is frequent it is best to sow rather thickly, because a number of young plants succeed in breaking the beaten surface when a small number might fail to do so. Now, however, that germination is more rapid and there is little likelihood of there being too much rain, the seed should be distributed as thinly as possible, saving a great deal of labour in thinning.

Onions: Pickling-onions are obtained by sowing the Silver-skin variety on very poor soil, which must be of a good working description, towards the end of November. Make the surface firm by treading or rolling. Sow in broad drills about 1 ft. apart, rather thinly, and do no thinning. If weeds are not likely to be troublesome the seed may be broadcasted.

Other Sowings: Red beet of a long variety should be sown for winter use. Silver beet may be sown at almost any time of the year; possibly about now is the best time. The plants should be thinned to 12 in. apart. Sow a small breadth of turnips as required. Distribute the seeds rather thinly, and very little thinning will be required, this being done by pulling the roots as they become large enough for use. Cabbage and savoy should be sown about the 25th of November to provide the winter crop for the North Island. It is better to sow several weeks earlier in the South Island. Make successional sowing of peas, French and butter beans, lettuce, and radish. Pumpkins, marrows, pie-melons, water-melons, rock-melons, and hardy cucumbers should be sown in the open ground early in the month.

Asparagus: Cease cutting when peas come in. The heavier the crop that matures and dies down the better the prospect for the following season.

Celery: Early plants should be ready for planting out. Really good heads can be obtained only by the old trench method. There are many adaptations of this method, the principal difference being the width of the trenches and number of rows in a trench, the number sometimes extending to a dozen rows. The latest method is to use no trench at all, this being the plan at present most common in market gardens. A self-blanching variety—usually Henderson's White Plume—is grown. The plants are set out in beds 6 ft. to 8 ft. wide, with the plants about 10 in. apart. Close growing assists in the blanching. The resulting heads are small and not of great merit—quite satisfactory, however, for cooking purposes. The heads find ready sale, and though the price they bring is not great they cost little to produce and must be a very much more profitable crop than by the trench system. This plan is commended to those who are too busy to make trenches.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

TREATMENT FOR COW-POX.

O. W. G., Appleby :—

I have a cow which some three months ago suffered from an affection of the teats. It first appeared in the form of red pimples, which after a day or two turned into small sores; these in turn lasted about a week or ten days and then dried up. The cow has just come in afresh, and I find that the complaint has returned. Please advise.

The Live-stock Division :—

From the description we judge that your cow is suffering from cow-pox. Apparently the teats only are affected in this case; usually some lesions are found on the udder itself. Except from the initial feverish stage, and the pain brought about by the handling of the teats, the cow suffers very little, and the disease has no detrimental effect on the general health. Treatment should be directed to the healing of the sores. The milking should be done in as gentle a manner as possible. Where the teats are very sore a milking-tube might be used, care being taken, however, to keep the tube thoroughly clean. Boiling for five minutes before use is recommended. The teats should be bathed twice daily with a hot weak solution of washing-soda, carefully dried, and a little of the following ointment applied: Oxide of zinc 2 drams, carbolic acid $\frac{1}{2}$ dram, oil of eucalyptus $\frac{1}{2}$ dram, lard to 2 oz. As the trouble is contagious the cow should be handled last, or one person only allowed to attend to her.

TREATING BLOOD FOR FERTILIZER.

J. C., Taumarunui :—

I have an opportunity of obtaining a quantity of blood from the local slaughterhouse. What would be the best mode of treating it to make it applicable as a manure?

The Fields Instruction Branch :—

For small lots there are two methods that may be used: (1.) Put the blood into a jacketed metal container with an open top, and dry it either by steam or boiling water in contact with the outside of the vessel containing the blood. An ordinary large copper partly filled with water will serve the purpose very well, and into this you may put the vessel containing the blood. It is better to heat slowly, and stirring is an advantage also. Keep up the amount of water in the outside vessel, to make up for the evaporation of steam. The fresher the blood the less offensive will be the process. To the blood should be added ferric-sulphate solution equal to about 1 part of dry sulphate to 100 parts of blood. This will prevent frothing when the blood is heated up. After the blood is coagulated and most of the moisture is driven off it can be allowed to drain (say, on galvanized iron) and dried under cover. Do not allow it to get wet. (2.) A simpler method would be to mix 1 to 3 parts of quicklime to 100 parts of blood, which converts the blood into a solid cake that can be dried in the air without any putrefaction. As a result you will have a mixture that breaks down into a powder, without any offensive smell. No special plant is required, and the final mixture has a greater fertilizing value on account of the added lime. Moreover, when this product is added to the soil it decomposes more readily, and becomes available to plants more quickly than the blood that has been treated with ferric sulphate.

IMMUNITY FROM WOOLLY APHIS.

R. BROWN, Waiau :—

Can you inform me if any research has been made in connection with the reasons why of two apple-trees of different varieties growing side by side one is immune from damage by woolly aphis while the other is badly infested?

The Horticulture Division :—

It is well known that certain varieties of apples are immune from attack by the woolly aphis. The reason for this immunity is a disputed point. The most generally accepted theory is that the bark of immune varieties is too hard to be pierced by the proboscis of the insects. The insects certainly will attack the immune varieties through large abrasions of the bark, which seems to support this theory. It is recorded that the wood of the Winter Majetin, a quite immune variety, has been analysed, and that it contains more lime than varieties that are affected by aphis. The additional lime might reasonably be expected to harden the wood. It is a fact that the wood of varieties that are most affected by the aphis is very soft in comparison with that of immune varieties.

CONTROL OF GORSE.

"GORSE," Whareama :—

On my property there is a considerable quantity of gorse growing on the river-bank, the soil being a soft silty formation. In some places it has been fired and allowed to come away green again, while in other places it has never been burned. Our County Council has now declared gorse a noxious weed, and I would ask your advice as to the best means of coping with the trouble.

The Live-stock Division (Noxious-weeds Inspection) :—

On river-bed land composed of sandy silt the most satisfactory and lasting method is to grub the gorse and put the land into cultivation for a few years, if it is possible to do so. The grubbing destroys the original plants, and the subsequent cultivation destroys all young seedlings which show up during the first year or two after grubbing. The land should then be sown down with a heavy seeding of strong holding grasses.

CLEARING LAWN-GROUND OF GRASS-GRUB.

"SUBSCRIBER," Oamaru :—

I wish to clear a small piece of lawn ground of grass-grub before resowing, and am anxious to know the mode of applying carbon bisulphide for soil-fumigation. I should also like to be advised if, in trying lime-water, a saturated solution should be used.

The Biologist :—

Really the best method of re-establishing an infested lawn is to keep the ground thoroughly cultivated during the months of October and November, and perhaps December, and then sow the grass-seed, provided water is available for watering the young grass. If no water is available, then the sowing should be delayed until the autumn. If this method is adopted no egg-laying will occur on the soft cultivated ground, and in consequence the grass will get a full year's start before any infestation can take place. Dealing with the grubs in the ground with carbon bisulphide is fairly satisfactory, but will not prevent egg-laying on the young grass if sown about October or November. Lime-water (saturated solution) will bring a good many grubs to the surface, but cannot be at all relied on as a method of control.

DIET, AND PROTRUDING RECTUM IN PIGS.

J. H. A., Manaia :—

I have some small store pigs some of which have the rectum protruding. They have been living on whey and turnips, and I have decided to change their food, thinking that this may be the cause of the complaint. I should be obliged for any information.

The Live-stock Division :—

A pig's diet should contain substances to assist in bone-making, and contain also a reasonable amount of protein. Neither of the feeding-stuffs given by you contains either of these in sufficient quantity to be useful. You should replace the whey with skim-milk in the meanwhile, and supplement it with pollard and a proportion of grain and linseed. While not condemning turnips, they should only be given sparingly. The feeding-troughs should be kept thoroughly sweet, and the pigs in a dry, airy sty free from draughts. The protrusion of the rectum should cease when you change the feed.

MOSS-INFESTED PASTURES.

HILL BROS., Piopio :—

We would like some information regarding moss-infested pastures. Our pastures were originally sown on bush clearings after firing, and have been grazed by sheep for the past dozen years. The land is hilly, and the climate very wet, with about 120 in. of rain per annum. We have ploughed a few acres and put down in grass after taking off turnips or oats, but this land is still infested with moss of two or three varieties. We have tried top-dressing with raw ground carbonate of lime, up to 1 ton per acre, and obtained no results.

The Fields Instruction Branch :—

Where pastures are infested with moss in a damp climate we would suggest that if possible the land be tine-harrowed and top-dressed with from 10 cwt. to 12 cwt. of burned or roche lime to the acre during the autumn, following with 3 cwt. of superphosphate to the acre during the following September. If quicklime is not available two or three times the quantity of carbonate of lime might be used instead. Should the matter be urgent tine-harrow before and after broadcasting 3 cwt. of basic superphosphate to the acre. This should be done as early as possible, in order to get the benefit of the spring growth.

STORING EGGS FOR INCUBATION.

"SUBSCRIBER," Mangere :—

What is the best method of storing eggs for the incubator? Do you approve of the method of storing in bran, on the large end, to avoid turning daily? Does blasting or thunder affect eggs that are being stored for setting? The blasting in this case is taking place about half a mile away.

The Chief Poultry Instructor :—

One cannot do better than store such eggs in bran, but I prefer to have the small end down. There is no need to turn the eggs daily. Of course, if they are being kept for, say, a fortnight the position of the eggs should be changed at least twice during this time. It is often said that thunder spoils the hatching-qualities of eggs, but my experience does not bear this out. The blasting you mention is taking place too far off to injure the eggs in any way.

STOMACH TROUBLE IN CALF.

R. B. S., Pukehuia :—

I shall be glad to know what treatment, if any, could be given to a calf with the following symptoms: It was feeding quietly in the paddock, but suddenly started to run around, always to the right, until it fell down. On placing it on the left side it immediately struggled until getting on its right side again. There was a certain amount of froth at the mouth, nostrils distended, and eyes dilated. It seemed to be in agony for just on an hour, when I killed it.

The Live-stock Division :—

The complaint described in your letter is frequently seen in young calves. It is due to acidity of the fourth stomach, causing coagulation of the milk in that organ, and giving rise to the symptoms described. Treatment is of very little use in this complaint, as usually the animal dies before it can be applied. As a preventive, however, a tablespoonful of lime-water can be given in the milk every time the animal is fed, with beneficial results.

GETTING RID OF WOODLICE.

C. F. L., Henderson :—

Would you kindly inform me of the best method of getting rid of woodlice on passion-fruit vines, orange-trees, and in a bed for raising tomato-plants? Observation by lantern-light at night reveals hundreds of these insects on the passion-fruit vines, which have been completely ring-barked at intervals on the whole length of the vine. Young orange-trees are also being attacked in the same manner, while in the tomato-bed the woodlice are destroying the plants as fast as they show up.

The Horticulture Division :—

Woodlice will eat almost anything. Being night feeders they are rarely seen by day unless disturbed. During the day they shelter in any dry place, under and among dry rubbish of any kind, including dry manure or hay. Box edgings often shelter them, and a favourite place is between or behind boards, especially those of a frame or greenhouse. Lacking a better place they will hide in cracks in the soil. Boiling water poured into crevices during daytime will destroy large numbers. Burn all loose rubbish, or, if of a kind that will decay, turn it over and pour water on it. Cultivate well and keep the place clean. Woodlice soon desert a place that is frequently disturbed. If it is convenient to give poultry the run of the place they will soon clear them out. Young chicks are greedily fond of them, and they are useful in a greenhouse; so also are the native frogs. Woodlice (*Oniscus ascellus*) are not insects, but crustaceans belonging to the same order as crabs, lobsters, and crayfish.

THE CURRANT-BORER.

W. F. PANNETT, Scargill :—

Will you kindly inform me as to the best method of destroying the grub which eats into the pith of the branches of currant-bushes? While liable to affection currants are scarcely worth growing.

The Horticulture Division :—

No effectual means have been found for preventing attacks of the currant-stem borer. Spraying with lime-sulphur is no doubt effective while it retains its strength, but it is more than doubtful whether a sufficiently strong solution could be applied while the bushes are in growth, and for a period no spraying is possible. The fact remains that many growers are very successful with currants. It is the black variety that is most attacked by borers and also that is most grown. The black currant will not succeed except on good land. It requires good cultivation, keeping the soil free from weeds and frequently stirred, also liberal manuring, to cause good growth. The stooling form of bush is adopted because by this means new growths are thrown up from below the surface of the soil. This makes it possible to frequently renew the bushes by cutting out wormy branches, which should always be burned to destroy the grubs.

TOP-DRESSING PASTURE.

W. H. E., Waihou :—

Will you kindly advise me as to the best time of the year to top-dress grass-land with basic slag? Which top-dressing manure do you consider gives the quickest results in the spring?

The Fields Instruction Branch :—

The best time to top-dress pasture with a high-grade basic slag would be during the month of May; it will be found that considerable benefit is derived by the extra growth in the winter months. A top-dressing which gives the quickest return in the spring is superphosphate, applied at the rate of from 2 cwt. to 3 cwt. to the acre.

CLEARING GARDEN-LAND OF TWITCH.

"TWITCH," Westport :—

I have been trying to reclaim an old garden which had become infested with twitch, but find it almost impossible to break up. Could you advise as to its treatment?

The Horticulture Division :—

There are two ways of clearing the ground of twitch. One is to break the land up and pick the roots out. If it is convenient to use a plough this would be the cheapest method. In such case the ground should be ploughed, then harrowed, and grubbed several times with a tooth cultivator. Most of the roots could be got out during one summer, and after that all stray roots should be taken out. If spade work is resorted to it would be best to trench the soil to a depth of about 30 in., placing the top spit with twitch-roots in the bottom trench. Very little would again come to the surface, and clean cultivation would prevent further trouble.

CORRESPONDENCE.

ERADICATING WILD OATS ON WHEAT LAND.

A CANTERBURY correspondent writes :—

"In the last July number of the *Journal* there is given among the 'Answers to Inquiries' a method of getting rid of wild oats. Knowing how widely these notes are read, may I be allowed to suggest an alternative method, which I think has the advantage of keeping the land under crop during the whole of the process of eradicating the wild oats. It is as follows :—

"In the autumn, after the affected crop is removed, grow a crop of Cape barley or Algerian oats for winter feed, either by ploughing and working the land and drilling the crop, or by broadcasting the seed on the stubble and ploughing very lightly (I use a disk plough) and then rolling. This germinates and finishes one lot of wild oats. Plough deeper in spring and drill rape, which will be fed off in December onwards—next lot of wild oats gone. In autumn plough and cultivate for oats and tares (a bushel of each), sown in, say, March, which will give a most lucrative crop of hay if cut in December just as the earliest oats have headed—third lot of wild oats gone. Plough shallow, roll, and leave for a few weeks till moisture comes; then plough deep and sow in autumn with grass—fourth and fifth lots of wild oats gone. Leave in grass for a few years, when a few of the remaining oats may die, and then break up again and put in rape; this should germinate any seeds that are left, so that the land will be ready for wheat once more.

"It will be seen that the crux of the method lies in the crop of oats and tares which occupies the land for the time of a cereal crop, but does not allow the wild oats to ripen. This crop is giving most satisfactory results with those farmers that have adopted it, as it can first be fed off in autumn and then produce an exceedingly heavy crop of hay in summer. It has further an excellent effect in smothering twitch that has been weakened by previous cultivation.

"My plan certainly does involve a temptation to let at least one crop (the oats and tares) go for so long as to let the wild oats ripen and shed their seed, and this would be fatal to the whole process. The plan given in the 'Answers,' however, to my mind, errs in the direction of being a counsel of perfection. It is the safest and surest and quickest plan, but it is so expensive that it is not likely to be often undertaken. My plan, on the contrary, works in perfectly simply with the ordinary operations of the farm: the oats are killed while profitable crops are being grown, and so it is much more likely to be adopted. In the case of twitch I have found farmers much more eager to modify their ordinary farming procedure so as to control the twitch than to adopt those heroic measures which alone can kill it directly, and I think that the same will apply relatively with wild oats. Of course, my plan demands an intelligent appreciation of the procedure recommended and an earnest endeavour to co-operate with nature's working."

THE BEET-SUGAR INDUSTRY.*

VICTORIAN EXPERIENCE AT MAFFRA.

(Concluded from September issue.)

Irrigation.

ALTHOUGH the beet crop holds remarkably well through dry periods because of its deep-rooting propensities, irrigation is undoubtedly very desirable in the Maffra district. It is a summer crop that absorbs a large quantity of moisture, and if by irrigation an abundance of this can be supplied during the youth of the plants to keep them growing freely without any check much better quality beets will be secured than if the plants are severely checked by lack of moisture in the summer and subsequently develop an abnormal growth in the autumn. High-quality beets need an abundance of moisture during the spring and early summer, and comparatively dry conditions towards autumn, in order that high sugar-content and purity may be encouraged to the utmost. This can best be regulated by irrigation. Any system of irrigation may show good results, but undoubtedly the furrow system is the best. Every second row should be furrowed out with irrigation-shovels placed on the cultivator. These furrows should be connected with the service channel or pipe, and water admitted in sections, as many rows as the water will supply being irrigated at the one time. In this way the water may be well controlled, and through the loose furrows it soaks well down to the subsoil without smothering the leaves, and very soon after the furrows may be cultivated to conserve the moisture. In this district irrigation is generally of most value in December and January, and sundry crops irrigated from time to time have responded most profitably.

Harvesting.

The term of beet-harvesting usually extends over the period March to June. A special two-point beet-lifter is used to lift the beets, or a single-furrow plough stripped of its mouldboard. The topping is done by contract at a price per ton, depending on the yield, and occupies a number of men. The beet-toppers pull and shake the loosened beets, and throw them into rows; then, with large beet-knives, they slice off the crown and tops, throwing the roots into heaps clear of weeds, &c. The carters fork the beets into drays, haul them to the factory or railway-siding, have them weighed and tared for dirt and faulty topping, and tipped from high beet-loading platforms into trucks, or dumped direct into the beet-bins ready for manufacture.

Excepting the crowns and tops, which remain with the grower as valuable stock-feed, the whole bulk of the crop has to be carted, and it would generally be considered unprofitable to cart beets more than five miles by road. The limits by rail depend on freight and loading conveniences. A good average yield of clean beets is 12 tons per acre, but a diligent grower should expect to do better than this.

Beet Pests.

The only serious trouble so far in this district has been occasional damage to the young beets by cutworms and tomato-weevils, but if taken in time these can be checked by the use of paris green or arsenate of lead. Nematodes, beet-blight, rust, root-rot, &c., have not yet occasioned any difficulty, and by rotation and careful cultivation growers should endeavour to avoid such troubles. Rabbits are partial to young beets.

General.

Good cultivation is essential to beet-growing, and this is the main reason why beet-growing improves the soil for other crops. Fertilization is very

*Bulletin No. 40, Dept. of Agriculture, Victoria, by W. L. Williams, February, 1920.

desirable, and growers in the Maffra district have now come to realize this, and seldom plant without fertilizers. The application of lime is good policy, but not yet practised to any extent here. Irrigation is the best assurance for consistent and profitable yields, and with a large irrigation system in course of construction for this district it should benefit beet-growers.

Systematic rotation of crops is very important, but rarely practised here; partly because farmers have been fortunate enough to get along all right without it. But as reducing areas, higher values, and increasing costs come into conflict with decreasing fertility, rotation will find its proper place in the maintenance and improvement of the productivity of the soil. Mainly have beet-growers neglected rotation, because they have to lease land at high rentals for short terms, and are compelled to grow beets on the same land from year to year. Although continuous beet-cropping is bad practice and not approved, it is interesting to note that, in spite of those who contend that beet-growing injures the soil, sugar-beets have now been grown on some portions of the Swan Estate, Stratford, for six consecutive years, and produced good crops every year. Regarding the influence of beet-growing on other crops, many favourable results have been observed. Four years ago Carr's Estate, Stratford, showed evident signs of being crop-sick. It was leased and put under beet for two seasons and yielded well. Immediately after the beet was lifted, in July, 1918, it was hurriedly planted to barley and oats, and yielded heavy crops of barley and 3 tons to the acre of oaten hay, quite superior to any adjacent crops. This area has again been cropped with barley and oats, and is yielding splendidly, and the oaten hay will again go 3 tons to the acre.

A farmer who follows diversified farming and rotation is well advised to give his best attention to 5 or 10 acres of beet rather than indifferently care for larger areas. A grower who is experienced and devotes himself almost wholly to beet-growing need have no anxiety about handling 100 acres of beet.

Beet-thinning is the main cash item of expense in the early stages, and the factories generally advance on any well-cared-for crop sufficient to meet this expense. As soon as deliveries commence growers secure progress-payments to meet the cost of harvesting. Labour is not difficult to secure if a good run and reasonable accommodation can be offered.

In America there are now being fully tested two beet-harvesting machines designed to mechanically lift the beets, top and place them ready for carting. These show great promise of success, and, if so, they will be a great economy, convenience, and encouragement to beet-growers.

General Beet-growing Methods and Approximate Costs.

The following is a very general estimate of beet-growing costs, which vary considerably according to the man and his methods, the farm, and the season :—

Dr.	Particulars.	Cost per Acre.		
		£	s.	d.
1.	Select the best land unless a strict rotation can be followed. Rent	1	10	0
2.	Plough or cultivate deep in autumn, about 10 in. or 12 in. ..	0	15	0
3.	Cultivate	0	2	6
4.	Plough or cultivate just medium depth in early spring	0	10	0
5.	Cultivate to good tilth, and fine clean seed-bed	0	6	0
6.	Seed about September, 18 in. or 20 in. rows, $\frac{3}{4}$ in. deep, 10 lb. to 12 lb. seed per acre, and fertilize	1	2	6
7.	Cultivate with special four-row cultivator immediately rows can be traced	0	2	6
8.	Thin when beets are very young to single beets at 10 in. to 12 in. spaces by contact	1	10	0
9.	Side-hoe beets	0	10	0
10.	Cultivate with special cultivator as required	0	7	6
11.	Irrigate and cultivate in December if required .. ..	..	..	..
12.	Lift beets, special lifter, March to June	0	10	0
13.	Top beets by contract, 15-ton crop	2	5	0
14.	Deliver beets to factory, approximate	2	9	0
Total costs		£12	0	0

Where a grower owns his own land and fully works his own teams he may pocket of these costs about half. If rightly irrigated the additional expense incurred should be handsomely repaid.

Cr.	Particulars.				Receipts per Acre.		
					£	s.	d.
1.	Clean beets, 15 tons, at 27s. 6d.	..	..	..	20	12	6
2.	Beet-tops, for fattening or dairying	..	..	..	1	0	0
	Total receipts	..	..	..	21	12	6
	Costs	..	..	..	12	0	0
	Net direct profit	..	..	..	£9	12	6

A good farmer under normal conditions should secure this return, but an indifferent farmer or adverse conditions may considerably lower the result. A good farmer under fortunate conditions may increase the advantage. The above costs at the moment are inclined to rise, but against this the local price for beets has been increased to 30s. per ton.

BEE-SEED.

Supplies of high-grade beet-seed have always been procured from Europe, but during the war seed was most difficult to secure, prices advanced fourfold, and the pre-war standard of quality was not retained. Quality is all-important to the factory, but the Maffra growers are not yet directly interested, because they are paid a flat rate for their beets regardless of quality. When the industry is more fully established there is little doubt beets will be purchased on a basis of sugar-content.

Beet-seed may be satisfactorily grown here, but the maintenance and improvement of its sugar-producing propensities is a most elaborate business, demanding exceptional care and heavy outlay that may only become justified as the beet-sugar industry develops and creates a reasonable local demand for beet-seed.

Science has perhaps affected the characteristics of the sugar-beet more than those of any other known plant. Originally an annual, it has been influenced to develop sugar the first season and defer seeding until the second, thereby improving its opportunities for the development of sugar and lengthening the term for its extraction. Little over a century ago the plant yielded about 5 tons per acre of beets containing 5 per cent. of sugar. By most rigid selection and careful breeding the sugar-beet now yields from 10 to 20 tons per acre, and the beets test normally 15 per cent. to 16 per cent. of sugar, and sometimes reach as high as 25 per cent. of sugar. Such beets would naturally revert to a much lower standard very rapidly if not persistently and scientifically cared for.

Without entering into the elaborate details of high-grade beet-seed production, the following will be sufficient to indicate that beet-seed-growing is an important industry which cannot safely be trifled with.

(1.) Specially selected super-elite pedigreed seed is planted towards summer. In the autumn every beet therefrom is carefully tested physically and chemically, and those few passing the rigid tests are siloed or stored.

(2.) In spring of the second season the stored mother beets are again submitted to physical and chemical tests, and planted to produce in the autumn a crop of super-elite and elite beet-seed.

(3.) In spring of the third season the elite seed is planted, and but lightly thinned to secure long, small mother beets called "stecklings," which are lifted in autumn and siloed.

(4.) In spring of the fourth season the "stecklings" are planted, and produce a crop of commercial seed in the autumn.

(5.) In spring of the fifth season this commercial seed is planted, and produces beets in autumn for the manufacture of sugar.

Every year the super-elite seed must be carefully selected for the foundation of a new series. Germany and France in particular have specialized in the production of high-grade beet-seed, and owing to the difficulties occasioned by the war America has gone rapidly, largely, and no doubt successfully into the business.

In this district the factory has had to content itself with catch-crops of beet-seed. A reasonably high-testing plot of beets is reserved through the

winter, and the roots are replanted the following spring as mother beets, yielding a crop of seed which is used commercially. This seed-production has been very successful, the cleaning of the seed rather difficult, but the method, of course, is not safe. It has served a useful purpose while European seed has been so hard to secure, and the seed is probably more virile than the imported, but to continue on these lines would adversely influence the sugar-content. If elite seed were procurable from year to year the factory could produce its supply of commercial seed, which would have the advantage of being acclimatized, but it is unlikely that any reliable firm could be induced to part with its elite seed.

While the quality of the seed is so supremely important to success that no factory should even think of purchasing any but the very best, it is remarkable how climatic conditions may influence the sugar-content of beets and sometimes bring unjust criticism on the quality of the seed used. As an example, a set of results is submitted for comparison of Maffra results against Western District. The seed used in both districts was home-grown, and produced at the Maffra factory from a French strain of seed. The season 1918-19 at Maffra was exceptionally dry right throughout the growing-period, and the beets were stunted. At the usual time of maturity heavy autumn rains set in, and the stunted beets took on a second growth with a lowering of sugar-content and purity to such an extent that the average sugar-content for the whole of the season's beets at Maffra was only 13.49 per cent. The Western District beets evidently enjoyed a fairly normal steady growth throughout the summer, being favoured with the usual coastal showers. The beets consequently received no serious set-back, and came steadily to maturity, resulting in a much higher sugar-content than the Maffra beets produced from exactly the same line of seed.

Maffra Home-grown Seed (French Strain).—Sugar-content influenced by Climatic Conditions.

Plot No.	Location.	Topped Beet.	Sugar.	Purity.*	Sugar-content per Acre.	Remarks.
	1918-19.	Tons per Acre.	Per Cent.	Per Cent.	Tons.	
1	Maffra ..	15	14.0	80.6	2.10	Abnormal climatic conditions; unsteady growth.
2	" ..	15	14.4	81.1	2.16	
1	Port Fairy ..	20	18.0	90.6	3.60	
2	" ..	18	18.4	86.6	3.31	Fairly normal climatic conditions; steady growth.
3	" ..	19	17.2	91.4	3.27	
4	" ..	11	17.2	91.0	1.89	
5	Warmambool	17	19.0	88.6	3.23	
6	" ..	24	20.4	89.8	4.89	
7	" ..	23	18.4	88.1	4.23	
8	" ..	18	19.0	86.5	3.42	
9	" ..	13	20.0	89.1	2.60	

* High purity favours a high extraction.

The production of single-germ beet-seed is receiving a lot of attention in America, because such seeds would economize the cost of thinning considerably, and there seems every reason to believe that such a characteristic may be developed and fixed in course of time.

Imported sugar-beet seed a few years back could be distributed at 6d. per pound; recently it has cost in some cases as high as 2s. 6d. per pound, and is now being distributed to growers at 1s. 6d. per pound.

ESTABLISHMENT OF BEET-SUGAR FACTORIES.

The location and construction of a new beet-sugar mill calls for a lot of forethought and consideration, yet one is safe in saying that there is only one thing that need very seriously exercise the minds of those interested—"an assurance of a satisfactory supply of beets from year to year." This is most essential, and if assured an up-to-date efficient mill has no excuse for anything but success.

The supply of raw material is so important that no district should consider the beet-sugar industry without reasonable proof that the soil and growers are capable and willing to produce plenty of beets. When the farmers have promised suitable support in the way of raw material, which is more important than cash, then the promoters should secure independent rights over a few thousand acres of land to balance results against the natural inclination of many farmers to follow occasional high but varying priced crops. Frequently they follow such fancy crops one year too late. Furthermore, industrious beet labourers and new-comers sometimes desire to launch out as beet-growers, and the factory can then accommodate them with land at reasonable rates; whereas uninterested landowners are often disposed to force rents up unreasonably. The factory needs to regulate its supply, and to encourage growers to grow beets as profitably as possible, and a substantial area of land in the hands of the promoters to be subleased on easy conditions and cropped on a rotation basis is a great advantage and necessary to balance the production from year to year.

Capacity of Factory.

(Advisable for present Victorian conditions.)

A factory capable of treating 500 tons of beets per day is desirable. America tried European methods and small-capacity mills, and practically all of these failed financially because America had to face high costs for labour and material. Very much improved labour-saving and larger-capacity plants were then tried, and T. G. Palmer, a noted sugar authority, says, "To-day a 500-ton factory is regarded as the minimum-sized factory for profitable operation in America." These efficient plants have invariably made good wherever the supply of beets has been satisfactory. A majority of American mills treat 1,000 tons per day. At the same time it is not advisable to have the capacity of a mill ahead of the quantity of beets readily available within easy distance.

To satisfy a 500-ton mill 4,000 acres of beet is desirable, but the first season both growers and factory would be better served to start off with a smaller acreage well cared for, as it is a crop that demands good and very prompt attention at certain stages. Inexperienced growers and labourers would be more worried over half the area the first season than the full area after experience.

Cost and Factory Requirements.

Under present conditions it is impossible to make anything but a vague estimate of the cost of a 500-ton mill. Probably £150,000 plus working capital, plus sundry beet-loading and railway facilities, might be required, and undoubtedly a large part of the plant could be made in Australia to advantage. This would be a heavy outlay, due to the prevailing high costs, but running at capacity such a mill would directly employ six hundred men in field and factory, and be of interest to a very large number indirectly. Also at capacity it should annually produce sugar, &c., to a value approaching or exceeding the factory cost of £150,000.

40,000 tons of beets would cost	£ 60,000
Manufacturing costs, repairs, &c. (estimate) ..	45,000
Other costs, including management, interest and depreciation (estimate)	20,000
Operating-costs	125,000
Value of products, sugar, &c. (say)	145,000
Balance	<u>£20,000</u>

The running-costs and value of products are liable to much variation, and should only be taken as a very general indication of results. For safety the above valuation of products has been taken at a low figure.

A supply of 3,000,000 gallons per day of good water would be required during the operating-period. 5,000 to 6,000 tons of coal would be needed per annum, also 1,500 to 2,000 tons of high-grade lime rock. Large quantities of sugar-bags, cotton filtering-material, coke, manufacturing-supplies, and beet-seed would also be necessary.

A factory-site should be central to the beet areas, convenient to railway service, well drained, and such that surrounding areas could be irrigated with the waste waters if necessary.

The value of the industry to its district and the State is best measured by the amount of employment and the wealth it may produce and distribute per acre of land involved.

GENERAL INFORMATION.

America has nearly one hundred beet-sugar factories, producing about 800,000 tons of sugar, while cane interests represent about 250,000 tons; but America's home requirements are over 4,000,000 tons per annum, made good by large supplies from adjacent cane-sugar producers, mainly from Cuba. America is now learning to appreciate the many economic advantages of producing as much home-grown sugar as possible, and, realizing the improvement in agricultural methods due to sugar-beet-growing, the Government is doing its best to encourage expansion.

The demand in America, as in Australia and elsewhere, seems likely to keep well ahead of available supplies, and the *per capita* consumption is certain to increase with the improved living-conditions and the realization that sugar is one of the very cheapest forms of energy-producing food. The heat units of sugar amount to 1,814 per pound, which is very much ahead of most other foods, and distinguishes it as a particularly valuable energizing substance. At 3½d. per pound this "concentrated sunshine" is probably the cheapest and pleasantest means of developing and maintaining human energy.

The *per capita* consumption of sugar prior to the war in some of the principal countries was approximately as follows: United States, 89 lb.; England, 93 lb.; Germany, 45 lb.; Austria-Hungary, 29 lb.; France, 44 lb.; Russia, 25 lb.; Italy, 12 lb.; Australia (1918-19), 120 lb.

The world's production of sugar has shown a steady increase, but recently the demand has outstripped the supply, which has been steadied by the war. With a strong demand and many European beet-sugar factories destroyed, the production is not likely to fully satisfy the growing demand for some years to come.

World's Sugar-production.

Year.	Cane.	Beet.	Total.
	Tons.	Tons.	Tons.
1850	1,200,000	200,000	1,400,000
1860	1,341,000	450,000	1,791,000
1870	1,741,000	846,000	2,587,000
1880	2,027,000	1,820,000	3,847,000
1890	2,443,000	3,669,000	6,112,000
1900	5,959,000	5,944,000	11,903,000
1910	8,566,814	8,503,970	17,070,784
1914-15	10,165,700	8,216,800	18,382,500
1915-16	10,675,700	5,032,000	15,707,700
1916-17	11,383,800	5,673,200	17,057,000
1917-18	12,505,800	5,050,600	17,556,400

The world's requirements are now computed to be 21,000,000 tons plus a substantial annual increase for the future.

The production and consumption of sugar in Australia since 1911 has been approximately as follows:—

Australian Sugar-production.

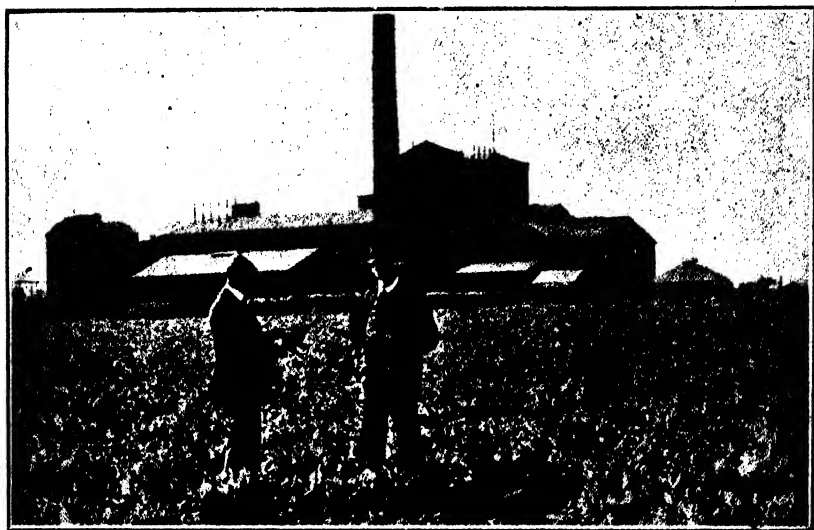
Period.	Production.	Consumption.	Period.	Production.	Consumption.
	Tons.	Tons.		Tons.	Tons.
1911-12 ..	190,595	233,000	1916-17 ..	193,037	266,000
1912-13 ..	129,877	241,000	1917-18 ..	327,589	274,000
1913-14 ..	265,029	255,000	1918-19 (estimated)	199,000	279,000
1914-15 ..	245,876	264,000	1919-20 (estimated)	155,000	285,000
1915-16 ..	159,640	262,000			

With a growing population and demand there is scope for increased production.

Apart from its direct worth in sugar the beet-sugar industry has been responsible for a notable and favourable influence on the agriculture of every country where it has been established. Both France and Germany largely put the beet crop in place of a bare fallow in their rotation system, and secured, in addition to the sugar, improvements up to 100 per cent. on the yield of grain crops so influenced. Australia's wealth and strength undoubtedly depend on the rapid and intense development of her rural interests, and the sugar industry, cane or beet, is capable of playing a most valuable part in such development, because it demands intense culture, and produces so much wealth per acre. Australia's sugar bill will soon largely exceed £10,000,000 per annum, an amount much better spent in Australia than abroad.

Some Difficulties.

Against the beet-sugar industry and many other industries the Australian frequently shows an inexcusable amount of prejudice and lack of patriotism, due



THE MAFFRA BEET-SUGAR FACTORY.

Beet-plot in foreground.

undoubtedly to a form of national modesty which causes him to denounce local products and praise imported. A little pride and confidence in our own products may be a wonderful stimulus to help increase production and improve the quality of our goods.

Constantly one finds people declaring that beet-sugar is useless for jams and preserves, and it is quite refreshing to read a recent report on "Why English confectioners prefer beet-sugar to cane for high-grade confectionery!" The reasons are substantial and interesting, but too lengthy to review here. In general, Europe has always held a splendid reputation for the quality of her confections, preserves, jams, and condensed milk manufactured almost entirely with beet-sugar. Chemically refined beet and cane sugar cannot be distinguished one from the other. They both adhere to the one chemical formula, $C_{12}H_{22}O_{11}$. It may be sometimes possible, but by no means certain, for manufacturers to distinguish by the grain. Housewives need have no anxiety in using beet-sugar. Europe has given it one hundred years' successful experience. America has made elaborate and definite tests with both sugars, and could find no difference in the results of the preserves and jams so tested. If the home-made jams and jellies fail it is

due either to faulty methods of manufacture, or more likely to the fruit. Wet-season fruits are far less favourable in quality than those matured under sunny conditions, and variations in quality can only be partially corrected by special care in boiling. If the fruit or boiling is faulty it does not seem right, though it may be convenient, to blame the sugar, which in itself is quite pure.

Even the landowner frequently takes a delight in declaring that sugar-beet-growing ruins the soil. With correct farming it can and does actually *improve* the soil. It certainly absorbs a lot of moisture, but that does not impoverish the soil, because it is constantly being replaced. From a sugar-production point of view the beet is simply a plant developed in the soil to manufacture sugar from constituents not of the soil. Sugar, or $C_{12}H_{22}O_{11}$, signifies a combination of water and carbon. The beet-leaves play a most important part in the production of sugar. They are studded with stomata, or breathing-pores, which breathe in carbon dioxide from the atmosphere, assimilate the carbon, and set free oxygen. Under the influence of the green colouring-matter of the leaves, or chlorophyll, and sunlight, the carbon dioxide combines with water in such a way as to form probably glucose first, then starch, gradually liberating the oxygen. Starch is insoluble, and is transformed into sucrose and glucose, and conveyed in solution to all parts of the beet-plant to aid its development, and towards maturity to store a liberal supply for the subsequent reproduction of the plant by developing seed. By harvesting the beets at maturity this seeding function is intercepted, and the stored sucrose is manufactured into commercial sugar for human consumption. Thus is energy actually won from the atmosphere and stored in the beet as sugar or "concentrated sunshine," becoming available under manufacture as a most valuable energy-producing food. From this it may be understood that the actual sugar in the beets does not in any way rob the soil of plant-food. The plant itself absorbs a quantity of plant-food, but with correct farming a great part of this may be restored to the soil in excellent form for subsequent crops. The tops and crowns which contain the bulk of the plant-food may be ploughed in or fed off and the manure ploughed in. The pulp containing the balance of the plant-food may also be fed to stock and returned in the form of manure. However, the great reasons for the improvement of the soil by beet-growing are—(1) The persistently intense deep culture demanded by the beet crop invariably improves the texture and productivity of the soil; (2) the deep-rooting disposition of the sugar-beet causes it to throw down a deep tap-root, under examination found to be massed with fibrous roots. These roots and countless rootlets reach to depths quite unusual with most crops, and greatly enrich the soil by bringing up fresh supplies of plant-food from the subsoil to the surface soil. At the same time they open up and aerate the subsoil, and add a mass of humus in the form of root-matter which gives life and vitality to the soil, and is so essential to fertility.

Both consumers and producers of beet-sugar might reflect on these matters, because practice as well as knowledge indicates that the industry is worth commendation rather than prejudice and denunciation.

CONCLUSION.

Regarding the Maffra beet-sugar industry it must be borne in mind that the mill was constructed over twenty years ago when manufacturing labour and materials were cheap. With this same plant, after lying idle for ten years and with no important improvements, the Department of Agriculture has made a clear demonstration that beet-growing and sugar-manufacturing may under Victorian conditions be quite congenial, profitable, and of great advantage to its district.

It has shown that a substantial rainfall or irrigation is necessary. It has also shown that with success comes the tendency for landowners to make it difficult for growers to secure sufficient land at reasonable rates. Although the factory's substantially capitalized plant, forced to operate on a small acreage with increasing costs of labour and material, has shown a degree of success and a satisfactory demonstration, it is not to be expected that the industry can expand and take its rightful place as a vigorous industrial proposition without sufficient land to produce a satisfactory supply of raw material. Granted such, the mill, in order to cope with the supply and contend with high costs, would, as a matter of course, be remodelled and brought up to efficiency on a 500-ton-per-day basis, to the advantage of producer, worker, and consumer.

As a business proposition the Maffra factory, or any other mill that may develop, needs control of a substantial acreage of good land, suitable climatic conditions, and an efficient plant.

OFFENCES AGAINST THE FERTILIZERS ACT.

At the Magistrate's Court, Wellington, on 17th September, the New Zealand Loan and Mercantile Agency Company (Limited) was prosecuted by the Department of Agriculture on charges (1) of having sold fertilizers the official analysis of which differed from the defendant's invoice certificate to the prejudice of the purchaser, and (2) of having omitted the unit values from the certificate. The fertilizers (turnip and grain manures) had been found to be deficient to the extent of over 6 per cent. in soluble phosphoric acid and in potash by 0.8 per cent., the value of the total deficiency being about £5 10s. per ton. The defendant company pleaded guilty, giving as an explanation of the first-mentioned offence that wrong invoice certificates had been supplied inadvertently. The defendant was convicted on both counts and fined £5 and costs, the Magistrate remarking to the effect that the explanation advanced did not help the farmer who bought the

MOVEMENT OF BEES FROM THE AUCKLAND DISTRICT.

CLAUSE 4 of the regulations under the Orchard and Garden Diseases Act, for the better control of fire-blight (gazetted on 18th June last, and published in the *Journal* for July), unconditionally prohibiting the removal of bees from the Auckland District, has been revoked, and the following regulation substituted, coming into force on 23rd September, the date of gazetting:—

4. (1.) No bees shall be sent or brought from the prescribed area to any other portion of New Zealand unless such bees have been effectively quarantined for the six days immediately prior to their despatch from that area so as to prevent their having access to any flowers or other vegetation. (2.) The Director of the Horticulture Division of the Department of Agriculture shall appoint such places of quarantine, and shall prescribe such conditions for their use, as he deems necessary. (3.) Before sending or taking any bees out of the prescribed area the owner shall have them quarantined at one of the appointed places of quarantine. (4.) After completing the prescribed period of six days in quarantine the bees shall be forwarded direct from the quarantine place to their final destination, an official permit signed by an officer of the Department of Agriculture being attached by tag or label to each parcel of such bees. (5.) No bees shall be accepted for posting or for consignment by rail to an address outside the prescribed area without such official permit being attached to the parcel. (6.) All expenses of sending bees to a place of quarantine and of forwarding them on completion of their period of quarantine to their destination outside the prescribed area shall be borne by the original sender of such bees, and shall be payable on demand.



"GOLDEN SWAN" HEIFERS AT RUAKURA.

LAND FOR RETURNED SOLDIERS.

THE lands opened or to be opened during the current month comprise an area of 9,536 acres, subdivided into 120 holdings, mostly suitable for dairying. The principal settlements are Grange, Dromore, Broadfields, and Isleworth, comprising twenty-four holdings, all situated in Canterbury, and suitable for agriculture or dairying. Part of the sections in Isleworth Settlement have been sown in wheat and oats. The Waari Hamlet Settlement has been subdivided into twenty-seven holdings, in areas suitable for fruit and poultry farming. This settlement is close to Waikumete Railway-station, near Auckland, and is therefore adjacent to good markets. Other settlements to be opened in October are Paremata (in Hawke's Bay District), Tawhiwhi (in Taranaki), and also several areas of Crown lands scattered throughout the Dominion.

The lands at present notified as being open for selection during November are: Glangarry, near Dannevirke, of 1,950 acres, subdivided into twenty-three sections; Goat Hills Settlement, in Marlborough, of 5,046 acres, subdivided into four good grazing-areas; four pastoral runs, with areas of settlement land attached as homestead-sites, situated in Otago; and numerous areas of Crown land. The Morten Settlement, containing 68 acres, subdivided into thirteen sections, has been set apart for selection by tuberculous soldiers only. This settlement is situated near Mount Pleasant, Sumner, and should prove very beneficial to the health of the soldiers for whom it has been set aside.

AGRICULTURAL BURSARIES.

THE following is an extract from the annual report of the Minister of Education for 1919-20 :—

A system has been in operation since 1917 under which agricultural bursaries may be granted by the Education Department to qualified candidates in order to enable them to obtain necessary practical training for positions as teachers, or agricultural instructors, or as farmers. After the completion of their training the bursars are under a legal obligation to serve for a term of three years in one or other of these capacities.

The qualification for a bursary is Matriculation or a higher or lower leaving-certificate, and candidates are preferred who have received agricultural instruction during their secondary-school course. In addition, ex-students of teachers training colleges who desire to specialize in the teaching of agriculture may obtain bursaries to enable them to receive the necessary training in agriculture. Agricultural bursaries are tenable at an experimental farm, an agricultural college, or other approved institution for two years, with a possible extension to a third year. Bursars receive an allowance of £20 per annum with free tuition, and if obliged to live away from home a lodging-allowance of £30 per annum.

During 1919 nine agricultural bursars were in attendance at Lincoln Agricultural College, and one at Auckland University College. Seven of the bursars at Lincoln were in their second year, and the bursar at Auckland was in his third year, having spent the two previous years at the Central Development Farm, Weraoia. In almost every case the reports of the work of the bursars were highly satisfactory. The expenditure by the Department on agricultural bursaries in 1919 was £608.

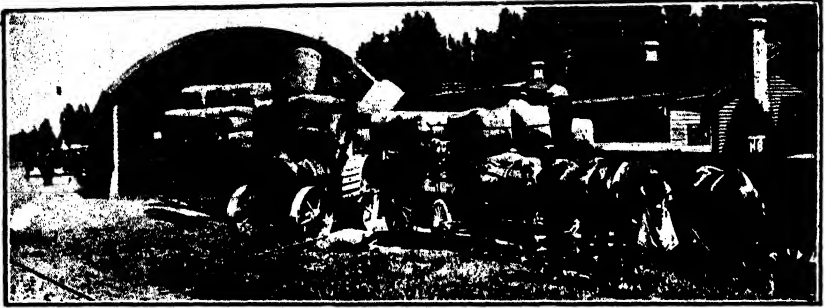
The regulations under the Education Act governing the award of bursaries for the purpose of promoting the study and practice of agricultural science (published in the *Journal* for February, 1917) were amended last month in several respects. The chief alterations in the conditions of tenure are: After completion of the original term of two years the bursary may be extended, in approved cases, for a further two years, instead of for only one year as formerly. The category of educational institutions at which the bursaries are tenable has been extended to include University colleges. The choice of occupations, in one of which each bursar must serve for a period of three years after completing his course of study, has been narrowed to that of teacher in a public, secondary, technical, or registered school, or in an agricultural college.

FORTHCOMING AGRICULTURAL SHOWS.

Marlborough A. and P. Association : Blenheim, 26th and 27th October.
Poverty Bay A. and P. Association : Gisborne, 26th and 27th October.
Wairarapa and East Coast A. and P. Society : Carterton, 27th and 28th October.
Manawatu and West Coast A. and P. Association : Palmerston North, 3rd, 4th, and 5th November.
Canterbury A. and P. Association : Christchurch, 11th and 12th November.
Wanganui Agricultural Association : Wanganui, 17th and 18th November.
Banks Peninsula A. and P. Association : Little River, 23rd November.
Thames Valley A., P., and H. Association : Te Aroha, 24th and 25th November.
Auckland A. and P. Association : Auckland, 3rd and 4th December.
Southland A. and P. Association : Invercargill, 14th and 15th December.
Tuapeka Agricultural Society : Lawrence, 27th December.
Woodville A. and P. Association : Woodville, 25th and 26th January.
Feilding I., A., and P. Association : Feilding, 1st and 2nd February.
Clevedon A. and P. Association : Clevedon, 5th February.
Otago A. and P. Society : Dunedin, 9th and 10th February.
Dannevirke A. and P. Association : Dannevirke, 9th and 10th February.
Masterton A. and P. Association : Solway, Masterton, 15th and 16th February.
Northern Wairoa A. and P. Association : Aratapu, 19th February.
Franklin A. and P. Society : Pukekohe, 25th and 26th February.
Egmont A. and P. Association : Hawera, 2nd and 3rd March.
Morrinsville A., P., and H. Society : Morrinsville, 9th March.
Matamata A. and P. Association : Matamata, 15th March.
Ashburton A. and P. Association : Ashburton, 17th March.
Methven A. and P. Association : Methven, 31st March.
Mayfield A. and P. Association : Mayfield, 31st March.
Oxford A. and P. Association : Oxford, 7th April.
Temuka and Geraldine A. and P. Association : Temuka, 7th April.

(A. and P. Association secretaries are invited to supply dates and location of their shows.)





The New Zealand Journal of Agriculture.

VOL. XXI.—No. 5.

WELLINGTON, 20TH NOVEMBER, 1920.

DRY-ROT OF SWEDES INVESTIGATION.*

PROGRESS FIELD REPORT, SEASON 1919-20.

E. BRUCE LEVY, Biological Laboratory.

A SERIES of experiments has been conducted in Southland during the past season in continuation of the investigation into the disease known as dry-rot of swedes (*Phoma napo-brassicae*). While the experiments are not conclusive as far as control is concerned many interesting facts have been elucidated, which will materially aid in the formulating of further work towards control. Most of the work has been carried out on the experimental areas at Gore and Winton, the actual field-work being under the supervision of the Local Fields Instructor, Mr. W. Alexander, whose careful attention, and that of the overseers at each place, tended largely towards the success of the experiments.

The experiments were along lines suggested by results of the previous year's work, and were designed to furnish information on the following phases of swede-production: (1) Production of a long-growing and slowly maturing bulb; (2) production of a large number of small, closely growing, hardy bulbs; (3) study of effect of seed-sterilization

* For the previous season's report see *Journal*, October, 1919.

and spraying of crop ; (4) study of crop-development following different times of sowing ; (5) effect of using seed raised in different localities or of varying origin ; (6) study of closely allied species of plants that might act as host plants for the disease ; (7) variety trials and studies in relative immunity ; (8) disease-resistant selection trials.

(1.) *Production of a long-growing and slowly maturing Bulb.*—It has been before stated in the course of the investigation that a large, rapidly maturing bulb is more susceptible to attack of the disease. The object of the experiments under this head was to produce a large bulb, the growing-period to be as long as possible. This would result in a firm-tissued bulb, and for a long period a large production of leaf. This large leaf-production seems to be an important factor in control. Whether the leaf covering acts purely as a shield against the wind-borne spores, or whether the more shady conditions set up are detrimental to spore-development, remains to be proved.

This phase was divided up into four sets of experiments : (1) Highly nutritive, long-acting manure—stable manure and stack-bottom, 20 tons per acre ; (2) straight-out slow-acting manures ; (3) quick-acting manures plus slow-acting ones ; (4) top-dressing of manures at various periods of growth of crop.

The stable manure and stack-bottom approached nearest the object aimed at. Both plots produced excellent crops of bulbs with a large amount of leaf-production. When finally examined 65 per cent. of the bulbs were affected with dry-rot—20 per cent. primary infection and 45 per cent. secondary infection.

There was no appreciable difference in the growing-period of the other manurial trials, with the exception of superphosphate, which produced noticeably a faster-growing crop. The occurrence of the disease was widespread throughout, certain plots being diseased to the extent of 90 per cent. Owing to the disease making its appearance more or less in patches throughout the trials, reliable detailed comparative analysis of infection was impossible.

(2.) *Production of a large Number of small, closely growing, hardy Bulbs.*—The trial consisted in rates of seeding and thinning, no thinning being carried out in certain cases. Others were thinned to 4 in., 8 in., and 15 in. respectively. Unfortunately, owing to a misunderstanding, the unthinned crops were not kept cultivated with the rest, and the yield was small. In the unthinned crops, on final examination, 14 per cent. of the bulbs were diseased, and in the neighbouring plot thinned in the ordinary way 40 per cent. were affected. (See Figs. 1 and 2.)

This method of not thinning, or thinning lightly, coupled with heavy manuring and intercultivation, is worthy of further trial on a field basis, so that the question of yield in comparison with thinned crops may be determined. The advocacy of this field method may seem to the Southland farmer a retrograde step in that fine art of swede-production acquired and practised by him. He must bear in mind, however, that although thinning is departed from, the practice of intercultivation, the undoubted keynote of success in swede-production, coupled with manuring, must on no condition be relaxed.

(3.) *Seed-sterilization and Spraying*.—The question of the liability of the disease to be introduced into a crop through the spores of the disease being inborne on or through medium of the seed is important of determination. Sterilization of seed by immersion in formalin and by the hot-water treatment was carried out, but these plots happened to fall on an area particularly free from dry-rot, so comparative analysis could not be made. Very little primary infection took place.



FIG. 1. UNTHINNED ROW OF SWEDES, SHOWING THE PRODUCTION OF CLOSELY GROWING, SLOW-MATURING, DISEASE-RESISTANT BULBS.

Tops removed to show the healthy condition of the bulbs. Photo. taken 1/8/20.



FIG. 2. SAME ROW AS IN FIG. 1, BEFORE REMOVAL OF TOPS.

Showing the good foliage cover secured in unthinned crops.

The spraying test, using 6-4-40 bordeaux mixture, was divided up into several trials, and where constant spraying was done (every fortnight after the disease first made its appearance) very little disease appeared. Ten per cent. of the bulbs were affected when spraying commenced, and subsequent infections amounted to only 2 per cent.

A good crop was produced, but the skins became very rough. In the adjoining plot, unsprayed, 36 per cent. were found affected at the final examination. One plot was sprayed as soon as the plants recovered from thinning, and once monthly thereafter. Infection in this plot amounted to 23 per cent.—11 per cent. primary and 12 per cent. secondary.

A rather interesting feature was brought out in the spraying trials. In order to facilitate spraying in one plot all the leaves were removed from the bulbs when the latter were between 3 in. and 4 in. diameter. This plot made practically no further growth. The leaves also were removed from certain rows in the stable-manure plot to see if leaf cover influenced secondary infection. The yield of bulb was considerably reduced by the removal of the leaves, which seems to demonstrate the value to the crop of promoting a long leaf-growing period quite apart from questions of dry-rot control.

(4.) *Times-of-sowing Trials*.—Weekly sowings were made from 30th October to December, and thereafter fortnightly until the middle of January. Among the earlier crops there was no appreciable diminution of dry-rot in any one sowing—that is, wherever a normal crop was produced dry-rot was prevalent. The value of this series lay more in being able to examine at one time a large number of bulbs in respective stages of development.

(5.) *Origin-of-seed Trials*.—Previous work had given slight indications that the origin of the seed sown influenced to a small extent relative dry-rot attack. Certain varieties of swedes were sown from the leading British seed-growing firms, but owing to the disease appearing in patches throughout the series comparative analytical work on degrees of infection was not carried out. Inquiries from Great Britain go to show that the main seed-growing district, East Anglia, is comparatively free of dry-rot, although in the south of Scotland it is fairly prevalent. The question of dry-rot dissemination by the seed is most important to determine.

(6.) *Host-plant Trial*.—The possibility of the disease wintering over on some plant other than swedes was taken into consideration in this series. On land previously in swedes which had been badly dry-rotted the following plants were sown: Rape, cabbage, broccoli, kohlrabi, thousand-headed kale, chou moellier, mangold, and silver-beet. No trace of the disease could be found on any of these plants, although club-root was bad in several.

(7.) *Variety Trials*.—A large number of varieties of swedes were tried, but no one variety, comparatively speaking, stands out conspicuously as being disease-resistant. The bronze-top type, however, when attacked do not seem so suitable a host as do the purple-top type, the disease seeming to work more slowly than in the case of Superlative or Monarch. Superlative perhaps takes the disease more readily than any other variety, and seems a very suitable host for the fungus to develop in rapidly.

(8.) *Disease-resistant Selection Trials*.—In August a selection was made from the twice-swede-land area, and nine large sound bulbs were picked out and transplanted for seed-production. Control along the lines of disease-resistance should be assiduously pursued.

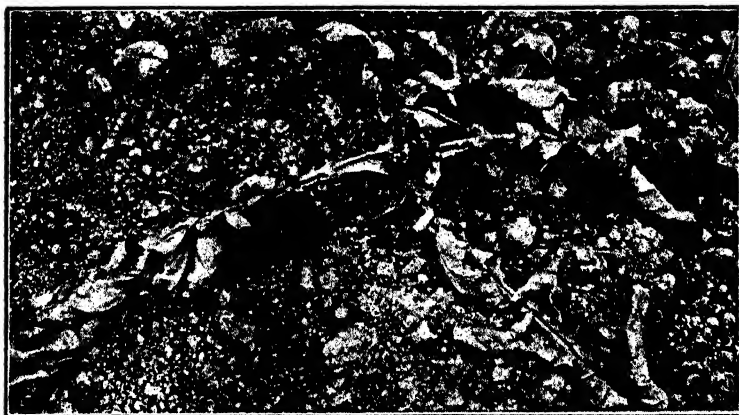


FIG. 3. SEEDLING-STAGE INFECTION.

Showing top withering away through infection of bulb at crown.



FIG. 4. SEEDLING-STAGE INFECTION.

Showing typical crown attack.



FIG. 5. PRIMARY INFECTION OF WELL-DEVELOPED BULB.

Infection has spread from the seedling-stage-infected bulb in foreground.

DRY-ROT ATTACK AND SPREAD.

There are, comparatively speaking, three relatively distinct stages in the attack on the crop. These stages are not separated by definite lines of cleavage, but each more or less merges into the other. In order to facilitate reference these three stages are here called—(1) Seedling-stage infection; (2) primary or main infection; (3) secondary infection.

(1.) *Seedling-stage Infection.*—Just how early loss occurs in the seedling stage has not yet been determined, but the first-noted effect of the disease is when the root commences to thicken out, approximately six to eight weeks after sowing. The occurrence of this seedling-stage infection, in every case noted, is around the crown. The leaves soon fall back, and the disease works its way right round the neck, resulting at an early age in the death of the seedling bulb (Figs. 3 and 4). No case of recovery or of continued growth was noticed. It is this seedling-stage infection which influences one to the belief that the disease is inborne on the seed sown. At Winton, where there was hardly any disease present in the mature crop, two bulbs were found affected in the seedling stage. Both of these, however, were removed for microscopical examination.

The relationship of seedling-stage infection to subsequent spread is most important to determine. A certain amount of work was done in noting the spread of the disease from these infection centres, and wherever they were in contact with a neighbouring bulb that bulb rapidly went off with the disease (Fig. 5).

On 1st March certain rows were carefully examined, and each affected bulb was labelled as to the exact stage of the infection. The accompanying photographs show such a row, and give some indication of the spread from the early-infected bulbs. Fig. 6 is a general view of row. Fig. 7 gives a close view of the second label from front, where the spread was from the small bulb on the right. The bulb on the left was perfectly whole on 1st March. Infection, however, must have taken place very early after this date.

The spread of the disease, from whatever source, seems to be determined very largely by soil and climatic conditions. Wet low-lying areas, when the disease once manifested itself, were subject to rapid spread. Even very small depressions of soil-level became the seat of bad infection (Fig. 8). Again, where the conditions were drier, even on the same area, and where there was seedling-stage infection, practically no further spread took place. Fig. 9 shows seedling-stage infection where conditions of soil, coupled with a hardier-natured bulb, retarded spread. Adequate drainage, deep cultivation, and liming are important factors towards retarding the development of primary infection.

(2.) *Primary or Main Infection.*—Whereas the seedling-stage infection results in the rapid death of the plant, primary or main infection comes on at a period when the bulb is advanced sufficiently that even when attacked normal growth still takes place, and the bulb is often able to attain to a large size before it is finally overcome by the disease. Others, again, if the attack is later and not too severe, may be able to keep going in spite of the dry-rot. Whether the bulb is finally killed outright or whether it manages to survive, primary

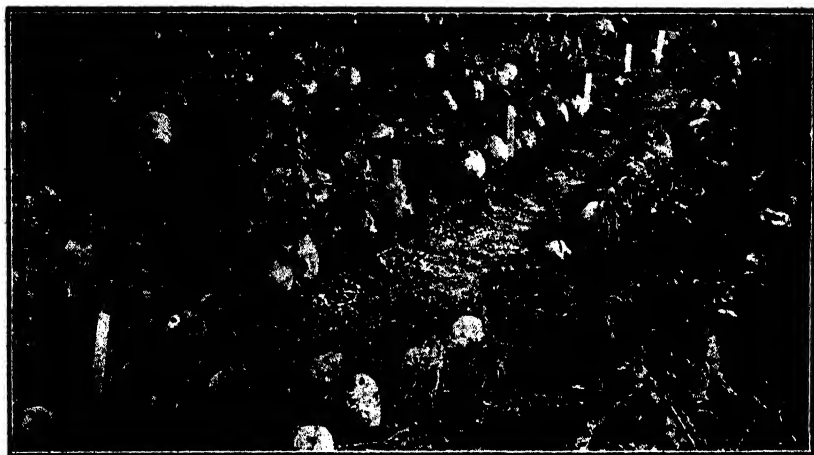


FIG. 6. SHOWING ROW MARKED ON 1ST MARCH TO NOTE SPREAD OF DISEASE FROM EARLY-INFECTED BULBS.



FIG. 7. SPREAD OF DISEASE FROM EARLY-INFECTED BULB.

Bulb on right was diseased on 1st March, when bulb on left was perfectly sound. On 1st August bulb on left was badly diseased through infection from the early-infected one.

infection causes large cracks or lesions to form at the centre of its attack. Generally speaking, neck-infection is the more common.

It is from this primary or main infection that the greatest apparent loss in the crops results. The infection period for this phase roughly extends from the middle of February to the end of April, and, generally speaking, bulbs attacked during this period rot away entirely by the end of August, when the damage becomes most apparent. Primary infection after the end of March is more likely to result in the partial rotting of the bulb.

Primary infection in the main is well above ground. It would certainly appear to be wind-borne spore infection, and the question naturally arises, from whence are these spores blown? The rapid death in the case of attack in the seedling stage would indicate that the primary infection was not caused as the young plant came through the ground, else it would have been killed out as in the seedling stage. The relationship of the seedling-stage infection and that of the later primary infection needs correlation. It would appear that the spores causing primary infections either are blown from the seedling-stage-infected bulbs or are blown up from the soil itself.

A good deal of evidence has been collected lending weight to the theory that the spore winters over in the ground. Crops grown on diseased ground two years in succession are more badly infected than on clean ground. At Gore on 1st March on twice-swede land 11 per cent. of the bulbs were affected, and on new swede land only 1½ per cent. were infected. Again, the infection of certain fair-sized bulbs at ground-level (Fig. 10) indicates clearly infection from the soil.

The development of the disease must be correlated with free access to light and air, for it is very seldom that attack takes place below the surface of the soil, and when a bulb is affected below the soil-level the disease area never assumes any size. A close relationship of spore-development to conditions of air, light, temperature, and moisture exists, but each one of these factors is, in the field, quite beyond our control. The fact, however, that the soil organism does not develop when at any depth limits our attack to the destruction of the spore on or near the surface. How long the organism will remain viable deep down in the soil has yet to be demonstrated.

Primary infection, when the attack is severe, in the main is more common in patches than in isolated individual bulbs, and these patches occur over an area, generally speaking, in soil depressions where the physical state of the soil generally is not conducive to a healthy bulb. Where a bulb is deformed by club-root dry-rot is often more severe on that bulb. The constitution of the growing bulb is an important consideration. The small, hardy, healthy bulb is resistant; the small weakly bulb is more subject to the disease. The development of the patches, therefore, may be either (1) natural spread of the disease from a common centre, or (2) spread of the disease in virtue of those bulbs being in the first place weakly constituted through growing in soil of a poor physical condition.

(3.) *Secondary Infection*.—Whereas primary infection occurs in the main in patches, secondary infection, where the primary patches are numerous, takes place over the whole neighbouring area. This infection is distinguished from the primary in that (1) no large cracks or

lesions occur on the affected areas (Fig. 11); (2) the infection works but slowly into the bulb; (3) numerous small diseased areas result instead of one or two large areas; (4) total loss of the bulb seldom results. The infection is no doubt due to wind-borne spores blown from the neighbouring primary infected bulbs.



FIG. 8. SHOWING DEVELOPMENT OF THE DISEASE IN PATCHES, DUE TO VARIATIONS IN SOIL-LEVEL.

In this instance the land was cropped twice in succession with swedes, but even so the higher ground was most free from the disease.



FIG. 9. SHOWING THE NON-SPREAD OF THE DISEASE FROM AN EARLY-INFECTED BULB (IN MIDDLE), WHERE THE GROUND WAS DRY AND IN GOOD PHYSICAL CONDITION.

The enormous amount of secondary infection as compared with primary infection, and its distribution over all portions of the bulb as against the more common neck attack of the primary infection, would indicate that a very great increase in the number of spores in

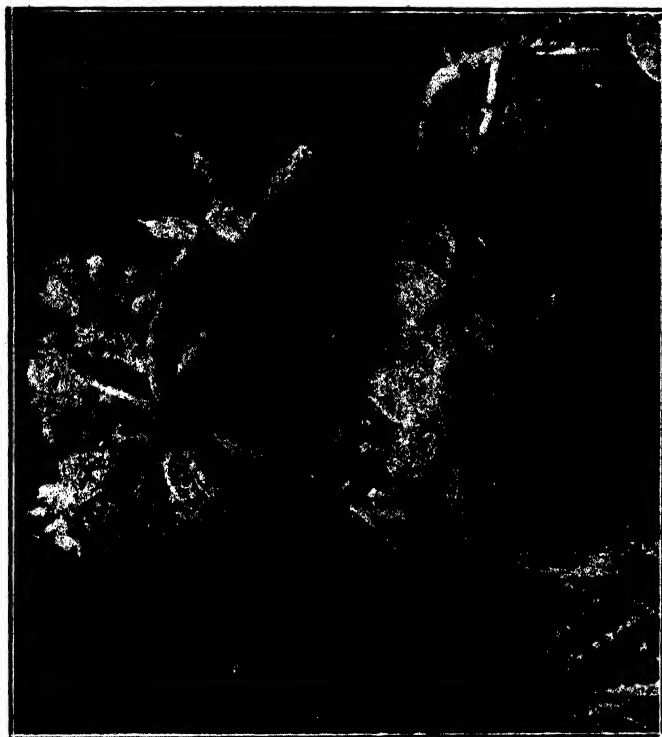
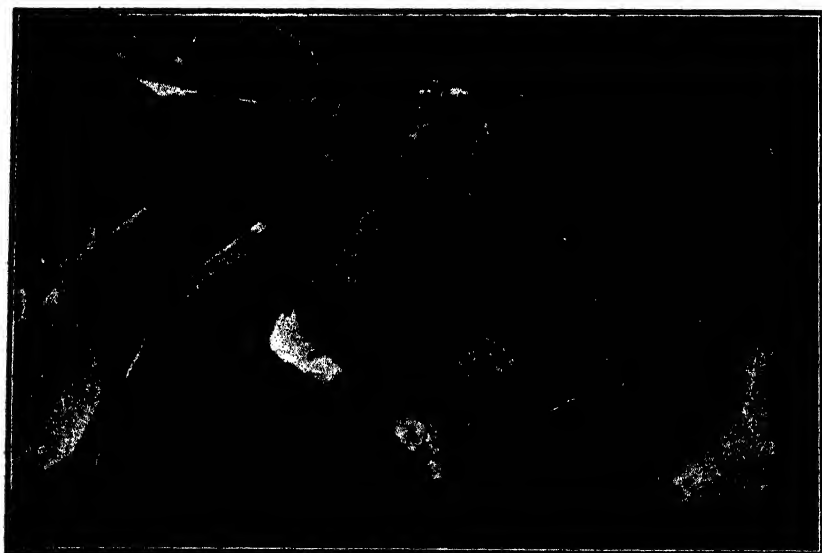


FIG. 10 [LEFT]. BULB SHOWING PRIMARY INFECTION AT GROUND-LEVEL.

Indicative that the dry-rot organism winters over in the soil.

FIG. 11 [RIGHT]. BULB SHOWING PRIMARY INFECTION JUST BELOW NECK, WITH CHARACTERISTIC CRACKING OF THE LESION AND NUMEROUS SUBSEQUENT SECONDARY INFECTIONS.



the air had taken place, and this no doubt is due to the relatively larger number of primary-infected bulbs present in the crop in comparison with the comparatively few seedling-stage-infected bulbs. The secondary is without doubt the sequel to the primary, and it would appear that the relationship which existed between the primary and the seedling-stage infection was co-ordinate with that existing between the secondary and the primary, the more common neck attack of the latter being accounted for by the fact that when primary infection took place the side of the bulb was protected largely by the leaf covering, the neck becoming the seat of attack in virtue of the spore being washed from the leaves down into the leaf-axil, where it germinated and established, the infection becoming noticeable at leaf-fall.

Secondary infection takes place from April to such time as the crop is utilized, and the degree of infection may be to some extent gauged from the following data: In one plot all primary-infected bulbs were pulled out at the beginning of March, and each succeeding fortnight newly affected bulbs were removed. The number of bulbs so removed each fortnight, commencing 1st April, were 31, 38, 48, 12, 8, 10, 13, 12, respectively, leaving on 1st August 77 bulbs. These figures would indicate that the secondary infection was most severe from 1st April to middle of May. The removal of diseased bulbs, however, no doubt influenced later secondary infections.

FUTURE LINES OF WORK.

The investigation will be continued during the present season, and will be confined mainly to dealing with the organism as it occurs in the soil, and in following up certain of those practices which show promise of success. A survey of a portion of last year's crop has been made, and this area is again being sown under soil-sterilization tests. The subsequent development of the disease on the control (untreated) plots will be correlated with the more or less patchy infection indicated by the survey.

[Photographs by E. Bruce Levy.]

Championship Shows.—At the last meeting of the Board of Agriculture the question of organizing a "Royal" championship show to be held alternately in the North and South Islands, so that visitors in search of stud stock would be able to see the best of the breeds in New Zealand, was considered. It was decided to endorse the recommendation, and a subcommittee was set up to formulate the best method of giving effect to the proposal, and to draw up prize lists for the champion classes. The matter had been referred to the Board by the Council of Agriculture.

Trees for Farmers and Local Bodies.—The total number of trees disposed of to farmers and local bodies by the Forestry Department's nurseries in 1919-20 was 277,235, a large decrease compared with the previous twelve months. The decrease was mainly due to the restrictions imposed by the Railway Department on the carriage of goods, and to a shortage of plants resulting from a bad season in the South.

WOOL-HANDLING AT SHEARING-TIME.

PREPARING THE CLIP FOR SALE.

J. G. COOK, Wool Instructor, Live-stock Division.

THE WOOL-SHED.

THE wool-shed should be thoroughly cleaned out a day or two before shearing commences—not merely swept by a broom, but washed out with water and a little disinfectant. Particular attention should be paid to the parts of the shed which the wool actually comes into contact with. On no account must twine, chaff, or rubbish of any kind be left in the wool-bins, wool-press, wool-room, or on the shearing-board; unless removed such substances are likely to get into the wool and depreciate its value when offered for sale. Sheep-skins should also be kept out of the shed during the shearing-period.

It is essential that there should be a good number of windows in the wool-shed, so as to admit plenty of light. This applies very strongly to the wool-tables, as it is of urgent necessity that there should be ample light at this part of the shed to enable those who are skirting, lapping, rolling, and classing the wool to do their work comfortably, expeditiously, and without error. In a large number of wool-sheds the light is very poor. Windows by the wool-table should be just about the length of the table.

TABLES AND BINS.

A suitable size of wool-table is 8 ft. 6 in. long and 3 ft. 9 in. to 4 ft. wide. It will be found very convenient to have the table canted—that is, one side higher than the other—and the higher side against the wall of the shed. The lower side is where the wool-roller is working from, and when he has done the work on the side of the fleece nearest him he simply reaches across the table and brings the far side of the fleece over to him. Having the table at an angle makes this easier than if the table was level. One often finds the tables made too small, with the result that the fleeces cannot be thrown out straight, which makes good work at the table very difficult, some of the skirtings being apt to be left on the fleece. When the table is a good length and width this greatly facilitates the work of dealing with the wool.

It is very handy to have a small table for putting the locks over. A size of 3 ft. 6 in. each way will do. Put $\frac{1}{2}$ -in.-mesh wire netting over the top of the frame, then nail a board on each side and allow the top edge of the boards to come 4 in. above the netting-wire. When the locks are placed on the table and shaken the rubbish falls through the netting, and dags and large pieces of wool can be readily picked out and each lot put in its place.

A very convenient size for the wool-bins (fleece and pieces) is 3 ft. wide, 4 ft. 6 in. deep, and 6 ft. high, which will hold about one and a quarter bales of wool. The width will allow three large fleeces in each row, or when the fleeces are smaller four will go in each row nicely for handling when pressing. Pieces or belly-wool can be thrown in and tramped occasionally, but each class must be kept in separate bins.

THE FLEECE-PICKER'S DUTIES.

After having shorn the belly-wool off the sheep the shearer should detach it from the fleece and throw it back on the shearing-board convenient for the fleece-picker to pick it up and examine it. If off male sheep the centre will be found stained with urine, and this part must be taken out at once by hand and put into a basket or sack. It is convenient for this purpose to have a sack hung in the corner of the catching-pen with the mouth of the sack open. These stained pieces must be dried outside in the open air before being pressed. After detaching the stained piece from the belly-wool the latter should be thrown into a bin allotted for that class.

When the shearer has finished shearing the sheep and let it go it will be found in nearly every case that the length of the fleece is lying across the shearing-board, the neck part being nearest the catching-pen wall and the hind quarters nearest the counting-out pen door. The fleece-picker will with his feet push the neck towards the brith of the fleece until he is in a convenient position, when, bending down and reaching forward at the same time, with his hands he catches hold of a hind quarter in each hand; then by making a half-circular movement with his hands away from each other he gathers the rest of the fleece between his hands, picking the fleece up and carrying it to the wool-table. Arriving there he turns the back of his hands upwards, and, making a throwing-forward movement, he releases the part of the fleece which he has between his hands, but retains hold of the part which he has in each hand. In this manner the fleece is thrown nice and straight on the table for the wool-rollers.

The fleece-picker will then return up the board and sweep the part of the floor from whence he removed the fleece, as there are always a few trimmings and second cuts to be removed before the shearer brings out another sheep from the catching-pen. In sheds where there is a large number of shearers the fleece-picker will find it convenient to pick the fleece up in the manner just described, put it down against the catching-pen wall, get hold of the broom, and sweep the stand clean. Having done this, he can then carry the fleece to the wool-table. The fleece-picker should see that his board is kept clean, taking all large pieces of wool or dags out of the sweepings and putting each class into the place allotted for it.

The fleece-picker will also put Stockholm tar or sulphur (whichever is provided for the purpose by the owner of the shed) on any cut on the sheep when the shearer calls for it. On no account is coal-tar to be used, as it goes hard, and will not scour out when the wool is being scoured; it also damages the machines in the woollen-mills if it has not been taken out beforehand.

Black fleeces should not be thrown upon the wool-table. Before the shearer brings a black sheep upon the board his stand must be swept clean of all white wool and the black wool kept separate. As soon as the sheep is shorn the fleece-picker should pick the fleece up, put it on the wool-room floor, rolled up with all the locks and belly-wool, where it will not come in contact with the white wool.

SKIRTING, LAPPING, AND ROLLING.

As soon as the fleece is thrown out on the table it is ready to be skirted. This is the critical stage of its preparation for market when

sold in the grease, and it is astounding how many wool-producers neglect to give the fleece the care and attention required—by skirting it properly and classing it. Some engage anybody to do this work, and seemingly are quite satisfied as long as the table is kept clear and the wool got out of their sight into a bale. A very large sum of money is lost to wool-growers every year by bad skirting alone, to say nothing of faulty classing.

Skirting consists in removing by hand from the fleece any outer edges which do not harmonize with the rest of the fleece. The following method is recommended: Starting at the britch, remove any part which is stained either by excreta or urine, going right across this part of the fleece. Having detached these pieces, throw them into a basket, which should be handy to the table for that purpose. Then work along the side of the fleece nearest to you, removing any dirty pieces with the one hand, and as you skirt this side turn the fleece in one-third its own width with the other hand. Now you come up to the armpit of the fleece, and this part should be watched carefully, as it is just here that the skirtings are the dirtiest, this being partly due to the action of the fore leg, and to the sheep when lying down always having this part in direct contact with the earth. Another cause is the action of the heart generating increased heat and perspiration in that part of the body. Now pass along up to the neck and cheek pieces, which must be removed. As a rule one finds that this wool is inclined to be a bit knobby or clubby at the tip, and it should be kept separate from the skirtings along the sides of the fleece. Now turn the neck part of the fleece back slightly towards the shoulders, and look back on the side you have skirted and turned in. The shorn side being up, you can see if any skirtings have been missed; if so, remove them at once. Then reach across the table with both hands, catch hold of the far side of the fleece, and bring the full side towards you until that edge rests flush with the side nearest you. This way of bringing it over brings the shorn side uppermost. Now go down the last side of the fleece, removing any dirty skirtings; with the shorn side turned up you can see at a glance what to take off. Working back from the neck of the fleece to the britch, throw the skirtings into the bin allotted for them, and the fleece, being properly skirted and lapped, is now ready for rolling. Turn the britch in and roll right from it straight out to the other end of the fleece. Fleeces done up in this way do not need tying of any description. This is the simplest, easiest, and quickest way of skirting, lapping, and rolling; the operator can always see over his work and rectify any errors when skirting, and the fleeces are readily handled afterwards. Do not adopt the practice of rolling the fleece from both ends. Such fleeces when being handled come loose, both ends bulge out, and rolling again is necessitated. Besides, there is always a loss of time when rolling at the table.

Carrying out the practice described, the following lines, which have been removed from the fleece wool, will result: (1) A pieces—the skirtings taken off on each side of the fleece; (2) neck-pieces; (3) stained pieces—wool stained either by excreta or urine; (4) belly-wool; (5) locks—the sweepings of the board and small pieces which fall under the wool-table.

CLASSING.

The classing of the clip should have the careful attention of the wool-grower. Wool-clips vary in every district, but the following notes will be found useful for classing.

"Combing" is a term applied to any wool which is strong and long enough to go through the combing-machine in the woollen-mills. "Clothing" is a term applied to any wool which has a break in the fibre, or wool which is too short for the combing-machine.

A or first combing: This grade comprises the finest, brightest, and cleanest combing-fleeces in the clip. The line should be made broad enough to take in the greater part of the combing-wool.

B or second combing: This takes in the coarser combing-fleeces, heavier in condition and duller-looking than the first combing.

C combing: This grade applies to a merino clip in which are found a number of fleeces of very fine wool, but having that heavy greasy tip on it. This wool is best kept by itself, as when scoured properly it will realize the same money as the A combing does when scoured, but owing to the big percentage of loss in scouring the buyer will not give so much for it in the grease as he does for the A combing.

Clothing: Fleeces which are clean, but either too short or too tender for combing purposes.

Dingy: This term covers any fleeces which have been discoloured either by climatic conditions, log-stain, or parasitic pests.

Sandy: This term covers any fleeces which have sand right throughout them. As the sand absorbs the yolk instead of the wool doing so, this wool is always found to be tender, and requires a lot of soap when being scoured. It is mostly found on sheep running on very high country.

Cotted or matted: These fleeces should be put in a bin by themselves. The cottiness is caused by the oil-glands failing in their duty.

Seedy: On no consideration should seedy wool be packed with clean wool. All lots must be kept separate if full value is to be received for clean lines. "Seedy fleece," "Seedy pieces," "Seedy belly-wool," "Seedy locks," "Seedy stained pieces," respectively, is the best way to mark each line which is carrying seed. Enter it thus in the wool-book; then there is no chance of it being put up for sale with the clean wool and interfering with the prices the latter will realize.

Double fleece: This means any fleeces which have not been shorn for two years or over.

Black fleece: As previously mentioned, this should not be thrown on the table, and must be kept away from the white wool.

PRESSING, WEIGHING, AND BRANDING.

The presser should see that his press is in order, and that the woolpacks before being used are put out in the sun, this making the sewing of the bale easier. When putting fleeces into the bale it will be found that three large fleeces will fit in each row, and that two rows are required to fill the square of the press. This is the best method, as in the first place it gives the presser a firmer surface to tramp down,

and the wool does not spring up as it does when it is just bundled in. Further, the weight is got in easier, and the wool is well shown in layers of six when the bale is opened for sampling.

After pressing comes weighing, branding, and entering the description of the wool in the bale in the wool-book. The bale should be branded on the cap end with the station or farm name and the number ; then the same done on one side, also branding on the class of wool in the bale. Say it is A combing, Romney Marsh hogget : the letters A over RM over H will do ; or if it is wethers W will suffice. If scales are available it is best to have the bale weighed.

All bales as soon as they are branded and weighed should be duly entered in the wool-book, with number of bale in left-hand column, description of wool in the bale in the wide column, and the weight in the three columns on the right. When sending the wool to market an invoice copied from the wool-book should be sent to the selling firm.

SHEEP-MANAGEMENT NOTES.

III. SHEARING PRECAUTIONS, AND BRANDING.

F. MACKENZIE, Inspector of Stock, Christchurch.

THE annual loss of sheep from blood-poisoning at shearing-time is yearly increasing, and preventive measures should have the serious attention of sheep-farmers. Unfortunately, a number of owners still persist in making use of the shearing-shed as a storehouse for all sorts of material—from dead skins to old and dirty sacks ; and as most shearing-sheds stand on piles, sometimes 3 ft. or 4 ft. high, the space underneath the shed is often utilized for all manner of purposes. The writer recently visited a property where the fowls were actually netted in under a portion of the shed, and a few yards farther away it served as a dog-kennel. It is therefore little wonder that heavy losses occur from infection at shearing.

The first consideration is absolute cleanliness of the shearing-board and counting-out pens. The floor and walls of the shearing-board should be thoroughly scrubbed with a disinfectant before and immediately after shearing. The counting-out pens should be swept clean and liberally sprayed with disinfectant, and afterwards a small quantity of unslaked lime spread on the pens.

The shearers' water-pots for cooling shears or machines are a likely source of infection. They should be cleansed with disinfectant, and when refilled with water a small quantity of kerosene should be added. The reason for this is that the kerosene floats on the surface, so that every time the shears are withdrawn a coating of kerosene adheres to the shears and acts as a very good disinfectant. Some years ago I investigated a mortality from blood-poisoning on a large back-country station, and the trouble was undoubtedly traced to the shearers' water-pots, for after treatment as described the mortality immediately stopped.

By far the most common cause of blood-poisoning is the entrance of germs through small wounds—wounds which are very often unnoticed by the shearers. As soon as these small wounds are covered over with scurf or matted wool the germs of blood-poisoning immediately become active. A sharp lookout should be kept, and no matter how small the wound each should be dressed with Stockholm or Archangel tar, which should be kept handy in a receptacle for the purpose. All excreta are hotbeds of bacteria, especially from such animals as pigs, fowls, or dogs, and the quartering of such animals in or near a shearing-shed should be carefully avoided. The excreta when dry are blown about by wind, and often deposited in the counting-out pens and even on to the shearing-board, or on to the fresh wounds while the sheep are held for counting and branding.

Branding.—Immediately after shearing all sheep should be carefully branded with the registered brand of the owner—that is, in all districts that are not exempt from wool-branding. Unfortunately, a number of owners brand in a very careless manner; the oil or paint used is not of the proper consistency and simply makes a blotch. Section 62 of the Stock Act states that all sheep shall be distinctly and legibly branded with the owner's registered brand, and for every such sheep not so branded the owner shall be liable to a fine not exceeding 10s. In the case of stragglers or sheep shorn by mistake, these should be branded on the head with the registered brand of the owners in whose shed the sheep have been shorn, or, if he has no registered wool-brand, with a distinguishing mark of paint or tar. Failure to observe these rules is often the cause of bad feeling between neighbouring owners, and sometimes ends in Court proceedings. All lambs should be branded not later than 30th April in each year.

TESTING OF NEW-ZEALAND-GROWN WHEATS.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

THE testing of New Zealand wheats by practical milling tests was commenced, in 1909, by this Department sending a number of samples to the Chemist of the Queensland Department of Agriculture, Mr. J. C. Brünnich, F.I.C., who reported on the quality of the wheats after putting the samples (which were selected in New Zealand by Messrs. G. Baylis and A. Macpherson) through an experimental mill. Mr. Brünnich's report (9/7/09) stated that all the wheats were excellent samples of grain, but (with the exception of the harder wheat Comeback) gave flours rather low in gluten and strength. The total points, judged by the following criteria—namely, appearance of grain, weight per bushel, ease of milling, percentage of flour, colour, gluten, and strength—ranged from 76 to 88 per cent. in the eight samples forwarded. Mr. Brünnich's test of Yandilla King (Australian-grown) was 84 points. In 1911 thirty samples from the South and North Islands were similarly kindly tested by Mr. Brünnich for the Department. These showed a range of from 77.5 to 85 per cent. of points. The results were printed in the *Journal* of June, 1910 (p. 21), and of May, 1912 (p. 410). The first-mentioned article also gave Mr. Macpherson's views

as to the millers' attitude regarding the introduction of new varieties of milling-wheats, with special reference to the Solid-straw Tuscan variety. In the May, 1912, *Journal* the present writer remarked as follows: "While it may not be altogether fair, without knowing more about the origin of the samples, to compare these wheats with those Queensland wheats tested by Mr. Brännich in 1909, it may be stated that of forty-eight samples the average of points gained was 83.3 in 100; in 1910, of fifty samples the average was 83.8; whereas these thirty New Zealand samples, it will be seen, give an average of 79.4." In 1914 Mr. Brännich was again approached to carry out some tests, but he was unable to comply.

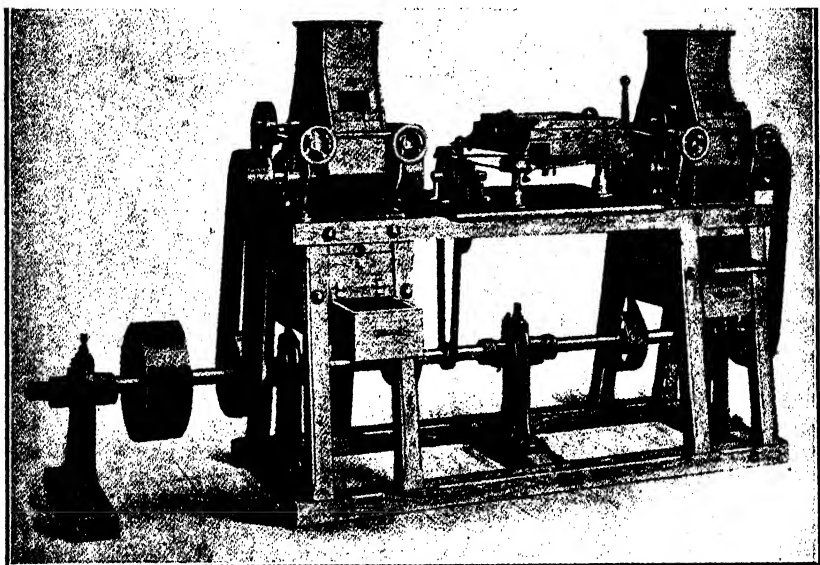
It will be noticed on referring to the records in question that none of these samples came from districts which are fairly similar in climate to Australia—namely, Central Otago and Marlborough. The results show some striking differences in the tests of the New Zealand wheats grown in climates similar to each other. What, then, may one expect of the results of those grown in dissimilar climates, such as the arid areas mentioned compared with, say, Timaru or Marton? A correspondent who has given much attention to the subject writes as follows: "Some contend that the farmer is not receiving under the present grading fair value for wheat grown, and that there is great need of protecting and educating him in regard to best wheats to grow. He can receive this protection and education by the Department of Agriculture having properly equipped means for testing wheat by chemical and baking tests. Under present conditions he has no protection, as the millers can condemn a wheat unjustly and give their own figure. Thus, no matter how good a wheat may be, both from a farmer's and a baker's point of view, the miller can, by giving less for it than for other varieties, so discourage farmers from growing it, or, more bluntly put, make it unprofitable for them to grow the variety. It is stated that a significant fact which proves this to be correct is that for over forty years no new varieties of wheat introduced into New Zealand have succeeded [commercially] owing to the attitude of the millers, and that the millers discourage the growing of any new variety if it yields well, so as to prevent farmers generally growing it on account of being accustomed to the mix necessary of the old variety, most mills not being equipped to deal with all varieties."

Whether these contentions are right or not, there is certainly enough evidence to show the necessity of testing wheat grown in New Zealand by means of milling, chemical, and baking tests. The Department has accordingly purchased and is installing in the Chemical Laboratory a small experimental roller flour-mill of the same type as those used in the laboratories of the Australian State agricultural chemists.

The results of the use of these mills will be found in the reports of the Queensland Department of Agriculture, and in a Bulletin of the Department of New South Wales, No. 7, 1912, where Mr. F. B. Guthrie, F.I.C., goes thoroughly into the value of a testing flour-mill to his Department. Jago, in "The Technology of Bread-making," page 847, "Milling Tests," states: "The only true test under these circumstances is the milling test, in which the various wheats are ground separately and their resultant flours tested chemically and by baking. They should then be mixed in the desired proportions, and again tested until such a blend is obtained as satisfies the miller's desideratum—a maxi-

imum of quality at a minimum of cost. With very small milling plants it is the custom to make a trial by putting a few sacks of a newly arrived wheat through the entire mill. But while this is a tedious and expensive experiment with a small plant it is practically an impossibility with a large one. The obvious alternative is to lay down a small milling plant for experimental purposes. This must not be too large, and yet must be large enough to make a fairly good commercial sample of flour."

It is hoped that as soon as the final fittings and adjustments are made to the Department's plant it will be possible to test a large number of typical samples of wheat grown in different parts of New Zealand, with a view to determining the best varieties to grow in each district for the production of flour.



THE ALLIS EXPERIMENTAL REDUCTION MACHINE.

The mill in question is made by the Allis-Chalmers Manufacturing Company, of Milwaukee, U.S.A., and is named the Allis Experimental Reduction Machine. It is fitted with corrugated and smooth rolls, by means of which successive reductions of the grain can be made, and the gyrating sifter is provided with a set of interchangeable sieves for making separations through different numbers of cloth. Owing to the small quantities of material handled continuous operation is not practicable, and the stock is passed by hand from one operation to the next. The model here illustrated has two pairs of rolls, but the machine purchased by the Department has three pairs, the frame being extended for that purpose. To give an idea of the size of the machine it may be stated that its height is 3 ft. to the table, and slightly more than 5 ft. over all. The power required to drive this mill is about 5 horse-power.

SORREL IN TURNIP CROPS ON LIGHT LAND.

CONTROL WITH SHEEP AND LAMBS.

E. B. MILLTON, Birch Hill Station, Rangiora.

It is accepted as an axiom by many who farm the light lands of the Canterbury Plains that it is impracticable to grow two successive crops of turnips upon the same land, for the reason that sorrel takes possession after the first crop. On the stony areas adjacent to the foothills the expense of breaking up land, either from tussock or old pasture, is considerable, and consequently it is often desirable to take a second crop of turnips in order to recoup the cost of the first ploughing. Moreover, the heavy natural manuring accruing from the feeding-off of a second crop, apart from the second drilling of fertilizers, assures the permanency and luxuriance of the grasses sown subsequently.

The writer has made it a practice for some years past to take successive crops of turnips off the same land, and has known no failures. He is satisfied, however, that in the variable and moist climate of the foothills it is useless to place reliance upon teams and implements to eradicate sorrel. The working of sorrel-infested land in the average local weather merely aggravates the evil. A simple control method is available in the use of a draft of weaned lambs. Upon most mixed farms there are sufficient lambs of an age suitable for weaning at the period when turnips are in the rough leaf.

The writer's practice is to keep the land intended for turnips stocked from the time the first crop has been fed off. Shorn sheep best serve the purpose, for the reason that they have no wool to suffer from dust. They should be kept running on the land during ploughing and all subsequent processes of cultivation and drilling, until the first seedling turnips make their appearance. Up to this point the sorrel has had no opportunity of raising its head because the young growth is eagerly sought for by the sheep.

For a short time, varying with the weather-effect upon the growth of the turnip-plant, the sheep must then be removed; but as soon as the foliage has a spread of 2 in. to 3 in. lambs, one to 2 acres or one to the acre, may be turned on to the crop, when they will seek and graze the sorrel, and most other weeds, in preference to the turnips. This reference, be it understood, is to rough-leaved turnips—not swedes. At this stage it is necessary merely to watch the lambs, preferably from day to day, and assure oneself that they are sufficient in number to keep the sorrel down, and, incidentally, to note that the crop is not stocked hard enough to force the lambs, through hunger, to feed on the turnips. It is a safe practice to change the lambs, or give them a run on grass for a day or two, after they have been on the turnips for about a fortnight. It may be noticed that a turnip-plant here and there has been cropped, but that will have been due to inadvertence, and not partiality, on the part of the lamb. When the turnips cover the ground the lambs have played their part and may be removed. If the lambs are not taken off or carefully watched there is a danger of damage to the roots when the latter become as large as a tennis-ball.

The following specific notes upon the practice just detailed are taken from a diary of 1917-18: Area of field, 50 acres. Rainfall—December, 1917, 9.92 in.; January, 1918, 3.14 in.; February, 1918, 4.12 in. Character of land, very stony. Condition, infested with sorrel after turnip crop. Owing to war conditions and wet weather ploughing was done intermittently. Ploughing commenced on 7th November, and was not finished until 17th December. Nine days were occupied in harrowing with giant tripod harrows. Drilling with Imperial Green Globe and 1 cwt. fertilizer per acre commenced on 4th January and ended on 9th January. During these operations a number of dry ewes—sufficient to keep the weeds in check—were running on the land, and were not removed till 14th January, when the seedling turnips were showing freely. On 21st January (only one week later, be it noted) 30 half-bred lambs were turned on to the 50 acres, and the results watched daily. Further references in the diary show that the lambs were put off the field on the 26th and not returned till the 30th, not because the turnips were being grazed, but because the lambs could not be closely watched. From the date last named the lambs remained on the ground until the turnips outgrew the sorrel and the crop was assured. The writer commenced the practice of lightly stocking young turnips in the summer of 1917, and, after assuring himself by personal attention to the test in 1918 that the practice was sound, has continued it with confidence and success.

It is perhaps as well to remark that wet ewes should not be turned on to young, succulent growth of sorrel, because they are apt to become "blown."

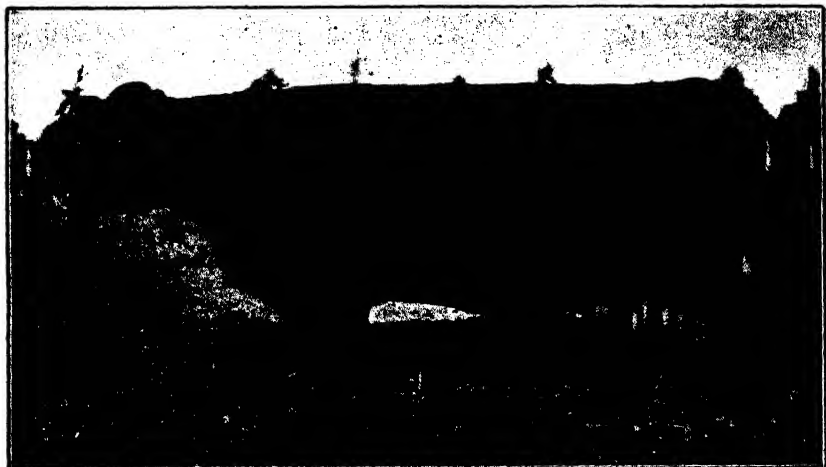
NOTE.—The fact that the rainfall in the country adjacent to the Canterbury foothills is much greater than in the lower plains must be given due weight when considering the application of the sorrel-grazing practice here described to drier areas. The article relates particularly to foothills conditions.—EDITOR.

RED POLL CATTLE.

THE WERAROA HERD.

THE appearance of cattle from the Department's Red Poll herd at several North Island shows this spring has caused much interest among farmers on those occasions, the breed being very sparsely represented in the Dominion, especially in the northern division. A few particulars of the herd—maintained at the Central Development Farm, Weraroa—and photos of some of its representative animals are therefore published for further information.

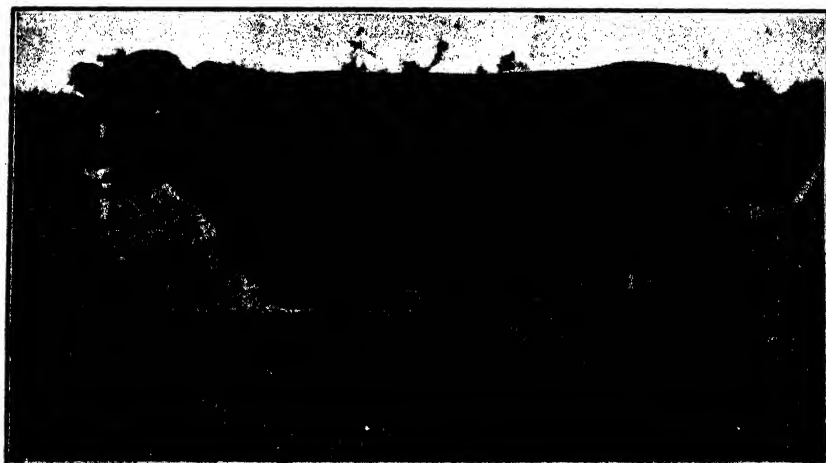
The herd was established in January, 1918, by importation of a selection of animals from the Werribee Experimental Farm Red Poll herd, Victoria, which in its turn was largely founded from direct Old Country strains of this ancient British breed, originally connected with the County of Sussex. The animals received from Werribee consisted of two bulls (Aviator and Force Majeur) and twenty cows and heifers. The aim since then has been to build up the number of the milkers, and fortunately for this purpose the progeny have so far been nearly all heifers. The numbers are now forty-five females and the two stud



GOLD TOP.



TWO FIRST-CALF HEIFERS: MELANESIA AND LUCKY HIT.



SYLPH.

bulls. Several young bulls have been sold at the last two Weraroa sales at good prices, the highest figure being 120 guineas paid for Dominion Air Raid by Sir R. Heaton Rhodes, whose Red Poll herd, at Tai Tapu, is one of the very few existing in New Zealand.

The Department's experience with the breed at Weraroa has been very satisfactory. The animals have well maintained the dual-purpose characteristics claimed for the breed. As showing the milking-capacity of the females it may be mentioned that fourteen out of eighteen cows and heifers averaged 8,256 lb. milk, 4.3 test, and 352.5 lb. butterfat during their lactation period last season. Seven of these were first-calvers. The following are some of the top records: Sylph, 10,998.25 lb. milk, 505.78 lb. butterfat (365 days); Gold Top, 9,492.25 lb. milk, 462.78 lb. butterfat (365 days); Opticia, 9,868.50 lb. milk, 436.66 lb. butterfat (359 days); Neutral (first calf), 9,427.25 lb. milk, 403.83 lb. butterfat (345 days). These records were obtained with twice-a-day milking and no special feeding—according to the practice followed at Weraroa in all record-testing—the animals being treated on a par with the rest of the herd. The results are all the more remarkable in that it has not been feasible so far to cull the herd on milk-yield. It may be added that no udder troubles have been experienced in the herd, and that the mortality has been nil.

The two stud bulls of the herd have exceptionally good milk records behind them. Muria, the dam of Force Majeur, holds a Victorian record of 14,792 lb. milk, and 885 lb. butterfat, in 365 days. Aviator is from the Virginia family, recognized at Werribee as the best-producing line of blood.

As regards beef characteristics, the milking-animals have maintained in general wonderful condition right through. They have shown themselves thrifty and hardy, wintering well and keeping their sleekness in remarkable degree. The weight of these nuggety beasts was shown at the Manawatu Show this month, when one of the Weraroa cows, Superior, registered 1,596 lb. on the weighbridge.

The accompanying pictures give a good representation of females of the Weraroa herd, but it must be noted that the photos of the cows were taken at the end of their milking-period when they had comparatively little udder show.

Basic Slag.—Summer top-dressings of basic slag have given quite good results both in New Zealand and Great Britain. It is advisable, however, to keep stock off the slagged pasture until rain has washed the material off the herbage.

Pinus radiata (insignis) Plantations.—The increased values of our indigenous timber have resulted in the felling and utilization of large quantities of *Pinus radiata* from farmers' plantations and shelter-belts. In many cases these plantation-trees had reached their natural maturity, and, provided new plantations are made, their use for timber was advisable, but it is to be feared that high prices have induced many farmers to fell plantations which should have been retained for shelter purposes.—*Forestry Department Annual Report, 1919-20.*

TESTING OF PUREBRED DAIRY COWS.

C.O.R. LIST FOR OCTOBER.

W. M. SINGLETON, Assistant Director of the Dairy Division.

THE list which follows contains the names of 128 cows and heifers the owners of which have received certificates of record since last publication. Jerseys, Friesians, and Milking Shorthorns are represented. For the latter breed a new class-leader appears, but there are no others, despite the fact that some of the classes contain records of special merit.

JERSEYS.

The honours for the junior two-year-old class in this list go to Meadowvale Silkgrown, owned and tested by Messrs. E. O'Sullivan and Sons, who also have three representatives with high records in other classes. Meadowvale Silkgrown is sired by Sunflower's Perseus, a C.O.R. bull with two daughters over 500 lb. butterfat, commencing test under two years of age, and one three-year-old daughter in the 600 lb. class. This bull represents the K.C.B. and Monopoly strains, well known as strains figuring in the pedigrees of a number of good C.O.R. Jerseys. The 600 lb. daughter of Sunflower's Perseus is Meadowvale Pegasus, who stands top of the list of three-year-olds in this report. This young cow is from Magnet's Peggy, a double granddaughter of Magnet's Boy. Magnet's Peggy is a C.O.R. cow with a production of 453.85 lb. butterfat in 315 days. The close relationship between Meadowvale Pegasus and Lady Peggy will be noted by interested breeders.

The three-year-old class has in addition to the one 600 lb. record three which have attained to the 500 lb. class. The premier position for these three 500 lb. cows is held by Eaton Ladybird, owned and tested by R. L. Parkin, of Fitzroy, New Plymouth. This young cow represents well-known strains, being sired by Pencarrow's General, a son of Fancy's Carnation Fox from Bridal Flower, who is a daughter of Viper. The dam of Eaton Ladybird is an untested daughter of Molina's General from an untested daughter of Silver King (Gould's).

The four-year-old class has been strengthened by another 600 lb. record, and two others which are over 500 lb. of butterfat. Woodstock's Princess was tested during her first lactation period, when, commencing at the age of 1 year 335 days, she won a credit for 496.48 lb. fat. Evidently this record did not do her justice, as she has been tested during the past season by her owner, Mr. H. J. Burrell, and has now raised her credit by 152.68 lb. at 649.16 lb. for her C.O.R., as here published. She is by K. See XV, from Sybil See, who is a daughter of the same sire. Sybil See's best record was 595.32 lb. butterfat, her test commencing at the age of 5 years 11 days. She is nearing the completion of another season under test, and her record is likely to increase the best previous record to some considerable extent. Evidently the concentration of K.C.B. blood in Woodstock's Princess has tended towards an increased production. K.C.B. has now twenty-three C.O.R. daughters, two of which have repeat records.

The records of Snowlette, tested by H. J. Burrell, and Decision, tested by W. H. Miers, deserve special mention, but lack of space prevents our going into detail.

The mature class is one with which all lovers of purebred dairy cattle have reason to be specially gratified. Of the first dozen cows, four have records in the 600 lb. class, and eight others have credits exceeding 500 lb. One of the 600 lb. cows, Woodstock's Baby, made a strong endeavour for the 700 lb. distinction. She has now been tested on three lactations. Her first test commenced before she was two years of age, and on this she won a record for 514.04 lb. fat. Her second test commenced at the age of 3 years 302 days, and on this she won a credit for 657.91 lb. fat, which gave her the leadership for that class. Her third test, as here listed, is but little short of the 700 lb. mark.

Messrs. Muggeridge Bros. are the owners of Jessica's Maid. She was, however, tested for them by Mr. S. J. Bennett, of Kaupokonui, to whose care and attention her splendid record is no inconsiderable tribute. The sire of Jessica's Maid is Mermaid's Sultan, a son of Campanile's Sultan. Mermaid's Sultan is therefore half-brother to Sultan's Daisy, a cow which we believe holds the world's record for twice-a-day milking, at 968.22 lb. butterfat.

In more ways than one, Peaceful, tested by Messrs. A. and J. O'Donnell, is a close neighbour of Jessica's Maid, and they represent the district near Manaia very worthily indeed. Peaceful is by Rainbow, who is from the same dam as Sultan's Daisy referred to above. The records of Jessica's Maid and Peaceful suggest that Sultan's Daisy inherited factors for butterfat-production to a marked degree from both parents.

We should like to comment on the records of more than a dozen cows in this list, but must have some regard for the Editor's viewpoint, and for this reason refrain from so doing.

FRIESIANS.

Of the records appearing in this list for the juvenile classes the production of Oakwood Betty stands out pre-eminent. An inspection of her pedigree suggests that, given the treatment she received at the hands of Mr. Brash, manager at Bainfield, she could not be expected to do other than place a good record to the credit of her owner, Mr. W. D. Hunt. Oakwood Betty is sired by Oakwood Holland King. His sire is King Segis Wild Rose Homestead (Imp.), who has some seventeen C.O.R. daughters with records ranging up to 706.55 lb. butterfat for a senior three-year-old. The dam of Oakwood Holland King is Dutchland Queen, who has a C.O.R. for 610.09 lb. butterfat. This cow is a daughter of Van Tromp, from Holland Queen, who held for quite a time the leadership of the mature class at 755.78 lb. fat. Van Tromp has eleven C.O.R. daughters, and Kruger II, the sire of Holland Queen, has thirteen. The dam of Oakwood Betty is a 482 lb. butterfat daughter of Rozine's Butter-boy. This bull has three C.O.R. daughters, including Oakwood Clover, who as a four-year-old has a credit for 580.10 lb. fat. Rozine's Butter-boy is a double grandson of Sir de Kol Inka Pietertje, who, like Kruger II, has thirteen C.O.R. daughters to his credit.

This month's list of senior three-year-olds has one record in the 500 lb. butterfat class in that of Bainfield No. 4. This cow was tested as a heifer, when she produced as a senior two-year-old 458.37 lb. fat.

The junior four-year-olds have also a 500 lb. class record. This was made by Viola's Pietertje Gem, owned and tested by J. J. Walker. She is a daughter of Viola, who was tested by James Parkinson, and has a C.O.R. for 661.16 lb. fat.

The highest-production figures in this list and the only 700 lb. record is that of Belle Fayne Segis, owned and tested by Mr. C. Goble, of Piakau, Inglewood. She is a daughter of King Fayne Segis II (Imp.), and from Belle, a daughter of Sir de Kol Inka Pietertje (Imp.) from Belle of Brooklands (Imp.). Belle Fayne Segis therefore traces entirely to North American strains. King Fayne Segis II is from a daughter of Johanna Rue III's Lad, who sired Finderne Pride Johanna Rue, a one-time world's record cow with a credit of 1,176.47 lb. butterfat. As already stated, Sir de Kol Inka Pietertje has to his credit thirteen C.O.R. daughters.

Friesland Wild Rose, a daughter of King Segis Wild Rose Homestead, has produced a good record for the mature class, and in this month's list of Friesians comes second to Belle Fayne Segis. Her dam is a daughter of Kruger II from a Longbeach cow.

The present list adds to the credit of the Friesians one record in the 700 lb. butterfat class, two records in the 600 lb. class, and five in the 500 lb. class.

LIST OF RECORDS COMPLETED IN OCTOBER, 1920.

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

JERSEYS.						
<i>Junior Two-year-old.</i>		Yrs.	dys.	lb.	lb.	lb.
Meadowvale Silkgown	E. O'Sullivan and Sons, Tariaki	1	359	240.5	365	8,359.4 527.99
Woodstock's Fanatic	Mrs. A. Banks and Son, Kiwitea	1	305	240.5	365	8,848.5 490.57
Cream K.C. ..	A. L. Hooper, Mahoe	1	297	240.5	365	7,970.7 489.13
Holly Bank Orange Lady	S. J. Bennett, Kaupokonui	2	10	241.5	365	7,901.0 479.68
Lucretia	H. R. Benbow, Ormondville	1	351	240.5	365	7,286.1 449.47
Beauty's Magpie ..	S. J. Bennett, Kaupokonui	2	26	243.1	365	7,992.3 430.40
Orange-girl ..	W. Anderson, Aokautere	2	17	242.2	365	7,298.1 415.81
Una of O.K. ..	V. W. Nowell, Hawera	2	40	244.5	318	6,559.8 393.66
Favorite's Miriam ..	A. J. Edwards, Ohaupo	2	13	241.8	365	7,238.95 389.08
Oline	J. G. Harkness, Wellington	2	1	240.6	365	7,623.6 379.15
Wattlewood ..	F. C. Ross, Kiwitea ..	1	360	240.5	335	7,251.2 373.69
Goldie's Sunbeam ..	G. T. Gibbons, Ngaere	1	364	240.5	339	6,463.8 362.34
Little Ruth ..	G. T. Gibbons, Ngaere	1	354	240.5	328	5,657.6 346.94
Raindrop ..	J. W. Bradey, Te Horo	1	364	240.5	365	5,821.2 340.74
Glenmore Belle ..	A. C. Lovelock, Woodville	2	9	241.4	291	7,027.2 334.25
Petune's Blossom ..	H. C. Sampson, Hillsborough	1	335	240.5	344	5,380.9 318.96

LIST OF RECORDS—continued.

Name of Cow and Class.	Tested by	Age at starting Test.	Fat rec'd. for Cent.	Yield for Season.		
				Days.	Milk.	Fat.
<i>Junior Two-year-old—continued.</i>						
<i>JERSEYS—continued.</i>						
Jersey Brae's Countess	T. Church, Te Rapa ..	Yrs. dys. 1 322	lb. 240·5	294	5,121·6	312·47
Springfield Rita ..	C. H. Thompson, Hastings	1 336	240·5	365	4,901·5	311·28
Carlita	Mrs. A. Banks and Son, Kiwitea	1 305	240·5	365	5,020·5	302·74
Orielton Meadow Queen	B. Tripp, Gleniti ..	2 30	243·5	327	6,148·0	302·27
Jerseydale's Elsie's Beauty	T. H. Broomfield, Auroa	2 44	244·9	349	5,269·0	301·54
Armidale Eva ..	P. A. Swney, Waihou	1 345	240·5	285	5,057·34	259·64
Black Bud ..	C. H. Weston, New Plymouth	2 35	244·0	311	6,920·6	254·89
<i>Senior Two-year-old.</i>						
British Maid of O.K.	E. S. Walker, Stratford	2 350	275·5	328	8,137·5	406·76
Cremona	H. Hodge, Alton	2 345	275·0	327	7,580·8	381·54
Flotsam's Hope ..	F. C. Ross, Kiwitea ..	2 295	270·0	327	8,080·5	371·55
Passion's Dream ..	E. S. Walker, Stratford	2 308	270·3	362	6,196·8	367·67
Lady Betty	S. Atkinson, Papatoetoe	2 337	274·2	365	6,346·1	365·17
Vesta's Lady Twylish	H. Hodge, Alton ..	2 212	261·7	319	6,320·8	364·42
Pride of Jersey Brae	T. Church, Te Rapa ..	2 288	269·3	312	6,202·0	332·61
Ruth of Gamboge ..	J. Rae, Taneatua ..	2 325	273·0	280	5,713·0	324·50
<i>Three-year-old.</i>						
Meadowvale Pegasus	E. O'Sullivan and Sons, Tariki	3 47	281·7	324	10,247·2	618·72
Eaton Ladybird ..	R. L. Parkin, Fitzroy	3 312	308·2	365	8,468·9	564·94
Meadowvale Good Hope	E. O'Sullivan and Sons, Tariki	3 234	300·4	365	10,678·5	555·86
Pulchra's Queen ..	A. L. Hooper, Mahoe	3 80	285·0	305	9,228·1	502·17
Perdita	A. L. Hooper, Mahoe	3 9	277·9	327	8,900·7	470·81
Cream of O.K. ..	T. Linn, Mangatoki ..	3 361	313·1	259	7,749·6	460·10
May Day's Favourite	D. P. F. Malone, Kaponga	3 234	300·4	331	6,489·6	425·10
Glenwood's Princess	W. J. Chynoweth, Cambridge	3 280	305·0	365	5,984·3	412·84
Penrose Queen ..	J. B. Clemow, Stratford	3 334	310·4	365	6,767·8	403·38
Beautiful May ..	J. A. Dobson, Kaimata	3 261	303·1	343	6,142·75	373·47
Lily Chase	J. I. Whitehouse, Ellerslie	3 325	309·5	353	6,071·0	358·29
Orielton Jutland ..	B. Tripp, Gleniti ..	3 21	279·1	312	7,749·7	357·48
Heather Queen ..	Kendrick Bros., Tariki	3 333	310·3	319	5,538·7	321·99
Luna of O.K. ..	J. Meuli, Normanby ..	3 300	307·0	342	5,453·0	313·40
<i>Four-year-old.</i>						
Woodstock's Princess	H. J. Burrell, Bunnythorpe	4 338	347·3	365	11,635·9	649·16
Snowlette	H. J. Burrell, Bunnythorpe	4 316	345·1	365	9,485·6	529·78
Decision	W. H. Miers, Rukuhia	4 342	347·7	365	10,513·1	523·00
Fancy Free	Mrs. A. Banks and Son, Kiwitea	4 247	338·2	365	11,330·2	491·91
Eileen's Lady ..	C. A. Care, Cambridge	4 254	338·9	365	9,147·9	481·35
Patch's Lizzie ..	W. Anderson, Aokautere	4 86	322·1	365	8,606·8	475·79
Dorothy Dainty ..	S. Atkinson, Papatoetoe	4 326	346·1	365	8,445·9	460·68
Magnet's Lady ..	T. Linn, Mangatoki ..	4 359	349·4	290	6,655·4	388·60
Prudence of Meadow Brook	A. E. Western, Hawera	4 86	322·1	296	6,563·6	327·17

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat rec'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

JERSEYS— <i>continued.</i>						
<i>Mature.</i>		Yrs. dya.	lb.		lb.	lb.
Woodstock's Baby ..	Mrs. A. Banks and Son, Kiwitea	5 2	350·0	365	12,881·8	690·16
Jessica's Maid ..	Muggeridge Bros., Manaiia	7 337	350·0	365	11,065·1	679·30
Peaceful ..	A. and J. O'Donnell, Inaha	5 359	350·0	365	11,772·3	635·07
Erin's Lone Star ..	E. O'Sullivan and Sons, Tariki	5 330	350·0	365	10,386·0	614·38
Enchantress ..	H. Salway, Bell Block	5 322	350·0	365	10,873·3	583·49
Mulberry Gem ..	R. L. Parkin, Fitzroy	8 357	350·0	358	8,626·6	578·84
Marion ..	H. Hodge, Alton ..	6 148	350·0	345	10,033·3	553·37
Spring Song ..	A. and J. O'Donnell, Inaha	7 300	350·0	365	12,076·7	550·04
Ngamoitu Weka ..	W. H. Miers, Rukuhia	8 120	350·0	365	10,668·1	545·80
Rosy Creek Merry Fairy	A. and J. O'Donnell, Inaha	8 264	350·0	365	9,839·0	531·09
Oaklea's Lassie ..	W. Duff, Auroa ..	7 297	350·0	349	8,463·0	524·95
Sunflower's Leila ..	P. J. Linn, Normanby	* 350·0	319	10,001·3	522·56	
Frisky Primrose Trixie	T. Church, Te Rapa ..	7 361	350·0	345	9,406·7	497·56
Penrose Vixen ..	J. B. Clemow, Stratford	6 289	350·0	365	7,962·7	493·12
Waipiko Mozelle ..	H. Hodge, Alton ..	7 6	350·0	334	8,761·3	466·15
Floria's Delight ..	J. F. Vosper, Matamata	8 278	350·0	353	8,164·5	460·02
Datura's Fancy ..	H. Hodge, Alton ..	7 332	350·0	324	9,906·8	439·56
Christine ..	E. S. Walker, Stratford	5 19	350·0	296	7,371·0	409·68
Rangitimu Tinsel ..	F. Hoskin, Matapu ..	8 149	350·0	290	6,954·8	363·65
Queen's Bess ..	F. Hoskin, Matapu ..	7 64	350·0	308	7,626·7	363·10
Meadow Queen's Ruby	T. Linn, Mangatoki	6 344	350·0	272	6,824·6	362·09
Amity ..	A. E. Western, Hawera	5 318	350·0	332	6,251·5	351·68

FRIESIANS.						
<i>Junior Two-year-old.</i>						
Ellesmere Fancy ..	T. H. Overton, Lakeside	1 330	240·5	342	10,466·8	420·77
Holland Queen Mona	S. Clements, Hamilton	1 308	240·5	365	10,772·6	401·71
Clover Pledge of Glen Lynne	S. Clements, Hamilton	1 305	240·5	365	11,507·9	370·80
Marchioness O'Gowrie	J. J. Walker, Ohangai	1 288	240·5	365	11,698·6	367·50
Lady Bountiful Domino	H. Johnson, Stratford	2 7	241·2	365	10,938·0	366·45
Poplarvale Pietje Pride	J. J. Walker, Ohangai	2 17	242·2	326	9,162·3	319·56
Cloverdale Ivy ..	A. Thirlwall, Matamata	2 41	244·6	281	7,756·9	276·69
Sadie Van Friesland Park	C. A. Fawcett, Clevedon	1 228	240·5	347	6,015·3	246·07
<i>Senior Two-year-old.</i>						
Oakwood Betty ..	W. D. Hunt, Invercargill	2 283	268·8	365	15,973·2	606·53
Holland Queen Woodcrest	J. S. Bairstow, Ruahwhata	2 252	265·7	326	13,663·2	465·68
<i>Junior Three-year-old.</i>						
Woodland's Cliffside Neta	W. Dew, Riverlea ..	3 63	283·3	300	12,382·2	462·95
Riverlea Lunta's Dutch	C. H. Steadman, Waikiekie	3 138	290·8	350	10,514·8	361·07

* Mature.

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cent.	Yield for Season.		
				Days.	Milk.	Fat.

FRIESIANS—<i>continued.</i>						
<i>Senior Three-year-old.</i>		Yrs. dys.	lb.		lb.	lb.
Rainfield No. 4 ..	W. D. Hunt, Invercargill	3 255	302.5	365	12,356.0	550.44
Kittannora Alcartra	R. Colee, Greendale ..	3 264	303.4	365	14,937.0	471.04
Lady Josina Segis ..	C. R. Duncan, Whangamarino	3 197	296.7	365	12,470.7	461.65
Oak de Kol Fobes II	C. H. Steadman, Wai- kiele	3 190	296.0	325	9,973.6	342.13
<i>Junior Four-year-old.</i>						
Viola's Pietertje Gem	J. J. Walker, Ohangai	4 21	315.6	365	13,724.4	546.12
Monavale Claudia Paxton	J. H. Wilson, Matamata	4 44	317.9	285	9,715.0	380.93
Expiation	W. H. Southcombe, Patea	4 12	314.7	296	9,760.6	367.21
<i>Senior Four-year-old.</i>						
Belle Fayne Segis ..	C. Goble, Piakau ..	4 332	346.6	365	19,568.6	702.25
Marlo Belgian Lassie	J. H. Wilson, Matamata	4 310	344.5	310	11,898.0	395.46
<i>Mature.</i>						
Friesland Wild Rose	W. I. Lovelock, Palmerston North	5 323	350.0	365	17,616.8	637.62
Bainfield Delhurst ..	W. D. Hunt, Invercargill	5 102	350.0	365	14,295.8	559.92
Lady Viola de Kol ..	Parkinson Bros., Opotiki	8 334	350.0	361	14,366.0	543.56
Princess Julip ..	J. H. Wilson, Matamata	6 4	350.0	299	11,313.9	508.86
Manor Beets de Kol	H. H. Hicks, Turua ..	5 6	350.0	306	13,877.0	482.15
Johanna Creamelle ..	T. W. Crossen, Selwyn	5 317	350.0	322	12,473.4	468.68
Bell No. 3 ..	J. H. Wilson, Matamata	6 351	350.0	319	11,088.8	390.49
Empress Burke de Kol	Parkinson Bros., Opotiki	7 122	350.0	306	9,755.4	354.21
MILKING SHORTHORNS.						
<i>Junior Two-year-old.</i>						
Cloverlea Queen ..	D. Buick, Palmerston North	1 335	240.5	365	7,527.2	317.80
Willowbank Sunshine	S. G. Morgan, Ngawapurua	2 53	245.8	365	6,075.9	275.11
Miss Massey A. ..	J. M. Whitham, Glenbrook	2 26	243.1	343	6,870.9	265.67
<i>Senior Three-year-old.</i>						
Terrace View Rosy II	T. De la Haye, Ngawapurua	3 360	313.0	365	13,270.8	577.00
<i>Mature.</i>						
Waitangi Madam ..	A. J. McGovern, Kio- kio	..	350.0	343	13,391.2	593.05
Parakau Gertrude ..	J. W. Anderson, Piarere	..	350.0	300	12,538.3	570.55
Dominion Jean of Ruakura	Ruakura Farm of Instruction	..	350.0	344	13,391.4	532.61
Birkland Daisy	G. N. Bell, Palmerston North	..	350.0	365	12,067.0	474.21
Pacakau Gem ..	J. W. Anderson, Piarere	..	350.0	301	10,078.7	459.63
Terrace View Pansy	T. De la Haye, Ngawapurua	..	350.0	365	10,468.0	450.30
Rushmere Poppy ..	W. H. Brewster, Feilding	..	350.0	365	11,120.5	449.46
Leeston Pet ..	J. Smith, Dannevirke	..	350.0	323	10,071.75	443.17
Parakau Biddy ..	J. W. Anderson, Piarere	..	350.0	298	10,634.5	443.06

LIST OF RECORDS—*continued*.

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cwt.	Yield for Season.		
				Days.	Milk.	Fat.
MILKING SHORTHORNS—continued.						
Mature—continued.		Yrs. dya.	lb.		lb.	lb.
Newstead Beauty ..	S. Lye, Newstead ..	..	350·0	336	10,860·7	417·54
Bushby Park Polly ..	S. Lye, Newstead ..	..	350·0	365	10,916·2	409·85
Newstead Champion ..	S. Lye, Newstead ..	..	350·0	350	11,033·2	402·34
Rushmere Granny ..	W. H. Brewster, Feilding	..	350·0	365	10,785·5	382·38
Parakau Florrie ..	J. W. Anderson, Piarere	..	350·0	303	9,558·75	372·17
Parakau Queenie ..	J. W. Anderson, Piarere	..	350·0	309	9,300·7	371·52
Netherby Mona III	R. Turnbull and Son, Sentry Hill	5 34	350·0	343	10,194·3	370·74
Lake Farm Dolly ..	J. E. Leeson, Morrinsville	8 22	350·0	286	9,132·7	362·63
Pukerimu Red Rose II	J. Fisher, Pukerimu ..	5 365	350·0	299	9,129·5	361·82
Lake Farm Ada ..	J. E. Leeson, Morrinsville	10 335	350·0	333	9,685·0	353·05

TOMATO-CULTURE AT THE COOK ISLANDS.

E. A. REID, Rarotonga.

TOMATO-GROWING for export to the New Zealand markets has become an important industry at the Cook Islands, and there is no reason why it should not become a permanent one, both soil and climatic conditions in Rarotonga being favourable for the cultivation of the tomato. Imported tomatoes are in demand in New Zealand from June to the end of November, while local supplies are off the market, and provided the fruit is carefully packed in uniform cases the Rarotongan growers can command the market during that period.

The following matter has been prepared with a view to assisting the less experienced growers, and as a guide to those who contemplate taking up the business. The local tropical references may also be of some interest to New Zealand horticulturists.

PREPARATION OF THE SOIL.

The tomato thrives on our island beach soil, well drained swamp-land, and on the mountain land, and with proper treatment of these soils it grows to perfection.

In regard to the mountain land, this soil is principally red clay, humus, except in a few depressions, being lacking. When ploughed, dress the soil with 20 cwt. of lime to an acre, and lightly harrow it in. Native coral lime will answer admirably for this land. Fresh roche-lime is apt to destroy any humus matter which may be in the soil, and the native lime is not so active. Do not pough the lime into the soil, as much of it would then be lost by the heavy rains which prevail in Rarotonga washing it into the subsoil.

The drained swamp-land will require a dressing of from 20 cwt. to 25 cwt. of fresh burnt or roche lime per acre. This class of land contains much residue and humus which has been washed from the mountains by the heavy rains. It is really our most fertile land, but requires a strong dressing of fresh lime to correct the acidity. The fresh lime will act more quickly than ground limestone, and for this class of soil it is preferable. Applications of lime pulverize the stiff clay soils, remove acidity, and at the same time render mineral substances into a suitable condition for plants to assimilate.

The beach soils contain a large percentage of decomposing coral, therefore a dressing of lime can be dispensed with, but before growing tomatoes a crop of cow-peas should be grown and ploughed in to provide a store of nitrogen and humus for the benefit of the tomato crop.

PROPAGATION.

Too much care cannot be exercised in the propagation of tomato-plants, and unless a grower is prepared to give thorough attention to this work and follow approved methods he would be well advised to leave tomato-culture alone and devote his time and labour to some other occupation more in keeping with his capabilities.

In seed-selection the grower should exercise every care to select only the best fruit from the varieties most suitable for the export trade—whether from the main crop or plants raised from new seed. A small quantity of the latter should be introduced every season from a reputable seedsman for the purpose of preserving vitality and keeping the strain from deteriorating and becoming susceptible to disease.

The first sowing for commercial purposes should be made during the end of March or the first week in April. Kerosene-cases cut in half make serviceable seed-boxes. These should have at least five holes of 1 in. diameter bored in the bottom, then a layer of gravel, to ensure proper drainage. Fresh-sieved soil is then placed in the box, and the seed sown broadcast and then lightly covered with more soil. Where fresh soil cannot be procured the soil for the seed-boxes can be sterilized by lighting a fire under a sheet of iron set up on stones or bricks, the soil being then placed thinly on the iron, and kept stirred or turned until heated to 210° F. This process will kill all weeds and insect life which may be present. The soil should then be left for some days for the action of sun and rain to restore to it, in some measure, the plant-nutrient which will have been destroyed by the heating process.

When sown, the boxes should be placed under the shade of light-foliaged trees—*Poinciana regia*, for instance—or a half-shade seed-house built of a rough framework and roofed with split bamboo, and the boxes placed on benches under this shade. A house of this description is very useful for raising other plants as well as tomatoes, as it affords necessary protection from the strong tropical sun.

When the seedlings are sufficiently grown to enable handling without injury they should be pricked off into boxes similar to those used for the seed. The plants should be placed at least 2 in. apart. In about twelve days the plants should be sufficiently grown for hardening off. Gradual exposure to the sun is necessary to prevent scalding. Place the boxes in the open during the afternoon. After a few days the plants will be fit for planting out. Some growers cover the shade-



A TOMATO AND BANANA PLANTATION AT RAROTONGA.

This plantation comprised 32,000 tomato-plants, in 4 ft. rows, 2 ft. apart in the row. The bananas are planted 20 ft. by 10 ft., and were five months old when the photo was taken.



ANOTHER VIEW OF TOMATOES AND BANANAS, WITH MANIHOT (TAPIOCA)
IN FOREGROUND.

house with coconut-leaves instead of bamboo slats; and when the plants are ready for hardening off they remove a few of the leaves each day, so that the plants will gradually become accustomed to the strong sunlight.

When transplanting knock off a side of the box, then each plant can be taken with a ball of earth, using a hand-trowel for the purpose. With care there should be no losses in transplanting.

PLANTING OUT.

The distance recommended for planting out is 4 ft. between the rows and at least 2 ft. between the plants, the rows running north and south. A space of 4 ft. between the rows allows the use of a cultivator, and, moreover, is a convenient distance when planting tomatoes between rows of bananas 20 ft. apart. The growing of bananas with tomatoes is recommended, as tomatoes should not be grown in the same soil for two successive seasons, while planting bananas 20 ft. apart and 10 ft. in the rows gives two crops for the same cultivation, and utilizes manure which may not become fit for assimilation by the tomatoes during the short season they are growing. Moreover, when the tomato crop is finished another row of bananas can be planted 10 ft. apart, thus giving all banana-plants a distance of 10 ft. by 10 ft., a useful distance for keeping the land in good tilth.

TRAINING.

The single-stem system is advocated for training tomatoes, as it allows of free cultivation, and there is no superfluous growth to harbour insect pests and fungus diseases, thus enabling spraying for their control to be easily and thoroughly accomplished. Also the plant is under complete control, and to get the best results this is imperative.

In training for single stem use stakes 5 ft. 6 in. long, and as the plant develops tie it securely, but not too tightly, to the stake with raffia or any soft tying-material. As the lateral growths appear they are pinched out. When a truss of fruit is set cut away the overhanging leaf to prevent shelter for caterpillars attacking the fruit. Other leaves removed are those which come in contact with the ground at the foot of the plant, but these are only cut away when the plant is developed. The plants are stopped or headed at the first leaf above the sixth truss of fruit, but five trusses are sufficient for a commercial plant, as reliance can then be placed on practically all the fruit being fully developed and suitable for commercial purposes. Leaves growing from the fruit-truss should also be removed, thus giving the fruit full benefit of nourishment.

CONTROL OF PESTS AND DISEASES.

As soon as the plants have started to grow after being transplanted spraying must be attended to. For caterpillar or leaf-eating insects use 1 lb. arsenate of lead to 30 gallons water. Mix the arsenate of lead with a little water in a bowl, then add to the 30 gallons of water. Stir the mixture thoroughly before filling the spray-pump. Spray every fourteen to eighteen days, or as soon as the insects make their appearance.

For fungus diseases use bordeaux mixture, a convenient quantity of which is made as follows: Dissolve 2½ lb. of sulphate of copper

with hot water, or by suspending in sacking in 15 gallons of water. Slowly slake 4 lb. lime by sprinkling with water. When slaked add 15 gallons of water, and pour both the sulphate of copper and lime solutions together into a cask and stir. Always use a wooden utensil for sulphate-of-copper solutions, and never allow the mixture to stand for more than eight hours.

Bordeaux can be advantageously used combined with arsenate of lead. A solution is then available for dealing with both fungus diseases and insect pests in one operation, which is a saving of time and labour.

The Vermorel Eclair knapsack fitted with Vermorel nozzle and elbow extension is one of the best pumps for spraying tomatoes; even with



PACKING TOMATOES FOR EXPORT AT RAROTONGA.

The variety shown is Trucker's Favourite.

Native usage they do not readily get out of order. New sets of valves are easily procured, and fitted with little trouble or expense.

Eelworm: This is one of the most troublesome pests to deal with. Clean soil for the seed-boxes and a rotation of crops is essential for success. For seed-boxes a useful virgin loam or a leaf-mould should be used, and if there is a difficulty in procuring these sterilize the soil.

MANURING.

Provided a useful loam or mould is procured for seed-boxes, and the land has not previously been cropped, no manure will be required until the first flowers are noticeable. Superphosphate can be then applied between the rows and lightly worked in with the cultivator. In a climate with a heavy rainfall, like that of Rarotonga, basic slag might prove of more benefit, but nothing definite can be advised until experi-

ments in this direction have been conducted. Where land has been previously cropped a mixture of bonedust, blood, and superphosphate is beneficial, and when bananas are also planted in the same area this mixture proves excellent for both tomatoes and bananas.

As regards green manure, cow-pea is without doubt one of the best legumes to grow in the tropics. The seed can be sown broadcast or in drills, and if the growth is ploughed in when the plants are in flower it will provide both humus and nitrogen for a succeeding crop.

VARIETIES.

A collection of 122 varieties of tomatoes has been grown at the Experimental Nursery, Rarotonga, and tested for commercial purposes. The following varieties proved good croppers and produced solid smooth fruits excellent for export: Cooper's Perfection, Sutton's Satisfaction, Sutton's Eclipse, Trucker's Favourite.

CROP-ROTATIONS.

As already mentioned, tomatoes should not be grown two years in succession on the same ground, and methodical crop-rotations are therefore advisable. The following is recommended as a good course: Tomatoes, cow-peas, kumaras, cow-peas—after which tomatoes can again be successfully grown.

BLACK-WATTLE BARK FOR TANNING.

STRIPPING, CRUSHING, AND PLANTATION MANAGEMENT.

J. F. SHEPHERD, Manager, Te Kauwhata Horticultural Station.

INQUIRIES have been received lately regarding the method of stripping and handling the bark of the black-wattle (*Acacia decurrens*) for tanning purposes. The Department is in a favourable position to afford first-hand information on this subject, having extensive old-established plantations of black-wattle on part of its horticultural-station property at Te Kauwhata, in the lower Waikato district. For many years past bark has been stripped there, and crushed at a mill on the property. A brief account of the practice followed at Te Kauwhata, together with some general notes on the subject, will therefore be useful.

Stripping is commenced in October, after the sap is up in the trees, as shown by the flowering, and is continued in November and December. The bark will not strip well unless the sap is moving. A preliminary work, where necessary, is to cut cart-tracks into the plantation to facilitate the transport of the bark, which is heavy stuff.

The method of stripping is to ring the tree with an axe 4 ft. or 5 ft. from the ground, and pull off the bark below this cut with the aid of a small crow-bar. As much bark as possible is then pulled off above the incision by an upward jerking motion. The tree is then cut down, and any other easily removed bark pulled from the larger limbs, &c.

It is not good practice to strip trees of less than 6 in. diameter, though as a matter of expedience many of those taken are of less measurement. The general principle followed at Te Kauwhata is to take out the best trees and allow the lesser or younger trees to develop, trees at various stages of growth and development being found in the plantations. A great deal of natural regeneration by the growth of seedlings is going on all the time.

The next operation is to cut or break the stripped bark into lengths from 3 ft. to 4 ft. long. The pieces are tied up with flax in moderate-sized bundles of about 80 lb. weight, and the latter stood up on end to dry. The bark is left in this condition for about three months (the summer season), when it is carted in, and most of it put under cover in the mill building for a further period of drying. It is found that if the bark gets wet at this stage it becomes tougher for crushing, and loses weight and some of its tannic acid. The drier the bark the better it crushes.

At Te Kauwhata the stripping and bundling is usually done by Maoris at contract rates. The work is fairly hard, and rough on the hands, and mosquitoes abound in the plantations. The job is therefore not usually sought after by local pakeha workers. The current rate for stripping and bundling is £1 5s. per ton green weight. The Maoris make on average about £1 5s. to £1 10s. a day, or even more. Contracts are often worked on family lines, the women taking an effective part and also making good wages.

Bark-crushing at the mill is a good winter or wet-weather job. The bark is very fibrous stuff, and the process is rather one of shredding than crushing proper. A great deal of fine dust is produced in the operation, and a flue is provided to carry this off from the machine. An engine of about 9 horse-power (steam) is required to work an average-sized crusher. The Te Kauwhata mill is provided with a 14 horse-power engine, but this is also used for sawing firewood, &c.

There is a ready local market in Auckland and elsewhere for wattle-bark, either crushed or uncrushed. The crushed stuff ready to go into the tan-pits is, of course, preferred by buyers, but producers who have no milling-facilities can dispose of their bark for crushing at proportionate rates. The price of uncrushed bark loaded on trucks at Te Kauwhata Railway-station, at time of writing, is £7 12s. 6d. per ton. Owing to the engine at the mill having been out of commission, the Department has latterly been disposing of its bark on this basis to a tanner in the Auckland neighbourhood. The price of crushed bark may be estimated at about 15s. or £1 higher than the uncrushed article.

On Te Kauwhata experience, an average plantation of black-wattle will take six or seven years to come to the cutting stage. It will then yield, in the first year, about 5 tons (dry weight) of bark per acre. The plantation can be gone through again for cutting every year or two, taking the best trees, as already indicated. If in the course of time a plantation becomes depleted and encumbered with felled stuff it may with advantage be fired, and allowed to regenerate with a clear start. If only parts of the plantation are so treated adequate fire-breaks must be provided.

The production of wattle-bark in New Zealand for tanning purposes is comparatively small, and local industrial requirements are met chiefly by importations from Australia and South Africa, a considerable trade being done with these countries.

Black-wattle, as is well known, makes splendid firewood, and is easily split. It also provides useful timber for farm purposes, such as posts, rails, &c. The posts, of course, are not very durable in the ground, but will serve their purpose for some years. The writer has tried tarring the butts, but finds that this process does not make them last longer. Some action of the tannic acid in the timber on the tar may possibly account for this. The firewood and timber may be regarded as a side-line of the bark-stripping, or *vice versa*, the trees being felled in each case.



CARTING IN WATTLE-BARK AT TE KAUWHATA HORTICULTURAL STATION.

A TIMOTHY Paddock IN SOUTHLAND.

W. ALEXANDER, Fields Instructor, Invercargill.

THE present note deals with one of the timothy paddocks on the farm of Mr. R. J. Anderson, of Kauana. Most of the fields are in timothy, but the particular one here described produces the annual seed crop. The area of the seed-paddock is 25 acres. It was sown down in timothy pure at the rate of 20 lb. per acre, and the last season's (1920) crop represents the twenty-first successive year of harvesting for seed. Taking the average over the whole period of twenty-one years, the crop has threshed out annually about 380 lb. of seed per acre. There have been seasons when the yield reached three bags, each of 180 lb., per acre, and, again, when wind has made havoc the threshed yield has been low. An indication of the quality of the seed is given by the official report on the germination of a sample taken from the 1920 crop when it was lying in store. The test was 99 per cent. in six days, with a final result of 99 per cent.

Mr. Anderson's treatment of this field is worth noting. Each season's crop is stacked and threshed in the paddock, with the result that a large

stack of timothy hay is available for winter use. The system is to then stock the paddock pretty heavily early in the winter, usually about May. As the winter progresses and it is known how the hay will last, the number of cattle is steadily increased according to requirements. During the last three or four weeks of its term, prior to being closed up, still more cattle are crowded on to it, and the final condition is that the paddock is carrying anything up to 125 head of cattle of various ages; in fact, Mr. Anderson states that he had as many as 150 on it for some weeks at a time. The result can readily be imagined. The whole field becomes simply black with animal-manure. This manure is then broken up and spread by means of tine harrows worked on their back, followed a week or two later by a set of short-tooth tine harrows worked with tines down. The field is shut up for seed usually before 20th September in each year, and the end of the following February usually sees the seed crop cut.



THE TIMOTHY SEED-PADDOCK AND STACK ON MR. ANDERSON'S FARM.

The cattle have free access to the stack during the whole of their time in the pasture. They eat it, and generally make themselves comfortable round about it. A low hurdle fence, forming a rectangular-shaped enclosure, is erected before the timothy is threshed. The stack is then built completely over it, the outside of the stack covering the fence to a depth outwards of perhaps 6 ft. The cattle can then burrow right in until they strike the fence. The idea of the latter in the first place is to cause the stack to be safe from falling over after having been eaten into. The cattle eating in to a depth of 6 ft. or so provide themselves with a veranda or roof, as it were, this making them just as comfortable as if kept in a loose-box.

The accompanying photograph by Mr. E. Bruce Levy was taken on the occasion of a visit to the farm in August last, and shows some ninety head of cattle around the last season's stack. At that time the pasture looked well and was wonderfully clean. Its condition and the number and quality of the stock, together with the very handsome returns obtained, all speak for the value of the field, and there seems no reason why this productiveness should not be maintained for many years to come.

PRIVATE FORESTRY.

"HOMEBUSH," CANTERBURY.

J. H. SIMMONDS, Auckland.

THE "Homebush" residence is thirty-six miles by road west from Christchurch and 800 ft. above the level of the sea. The estate touches the old moraines and ridges lying along the far-flung foothills of the once much loftier Southern Alps. It is in that happy zone that is reached neither by damp winds from the sea nor by violent blizzards from the mountains. Snow sometimes covers all the land in winter; but it falls gently, and soon again disappears at the touch of the sun through a cloudless sky. There is an annual rainfall of 39 in., which is sufficient for vigorous growth of grass and trees. The subsoil is deep and consists of fairly stiff clay mixed in places with water-worn stones. Very few trees have been uprooted by the wind. A good number have been stripped of their side branches by the snow, but this is an advantage. Here and there a Norway spruce or other tall specimen has been struck by lightning. Loss from these causes has been very small.

It was the late Mr. John Deans who founded the homestead and planted most of the trees. The bulk of the planting was done in 1870, and the work thence continued for about fifteen years. Mr. John Deans did not attempt the impossible task of covering open country with indigenous timber-trees. What remnant of native bush there was he conserved, as he had already done at his Riccarton home, near Christchurch; but the planting was practically all with exotics. Things were done that we of to-day with ampler experience would not do. Trees of inferior merit were given equal place with the best. Rapid growers and slow growers were planted together. Spacing of the plants was often too wide. But we have to look at the general result, and not to lose our sense of appreciation in any narrow spirit of criticism. On the part of the original estate now owned by Mr. James Deans and called "Homebush" the plantations total about 100 acres in area. They are exceedingly beautiful; and he would be a dull-minded observer who would not see that they are also of great economic value both for the shelter they give and for their timber-content. We cast no reflection whatever upon the energy and enterprise of the man who did the initial work when we say that the plantations would have been equally beautiful, equally effective for shelter, and very much more valuable for their timber had the inferior species been excluded and the good ones arranged in groups according to their rates of growth and ultimate dimensions. The meaning and importance of these general remarks will become more obvious if we now consider with as much detail as space will permit the several genera and species of which the plantations include representatives.

CONIFERS.

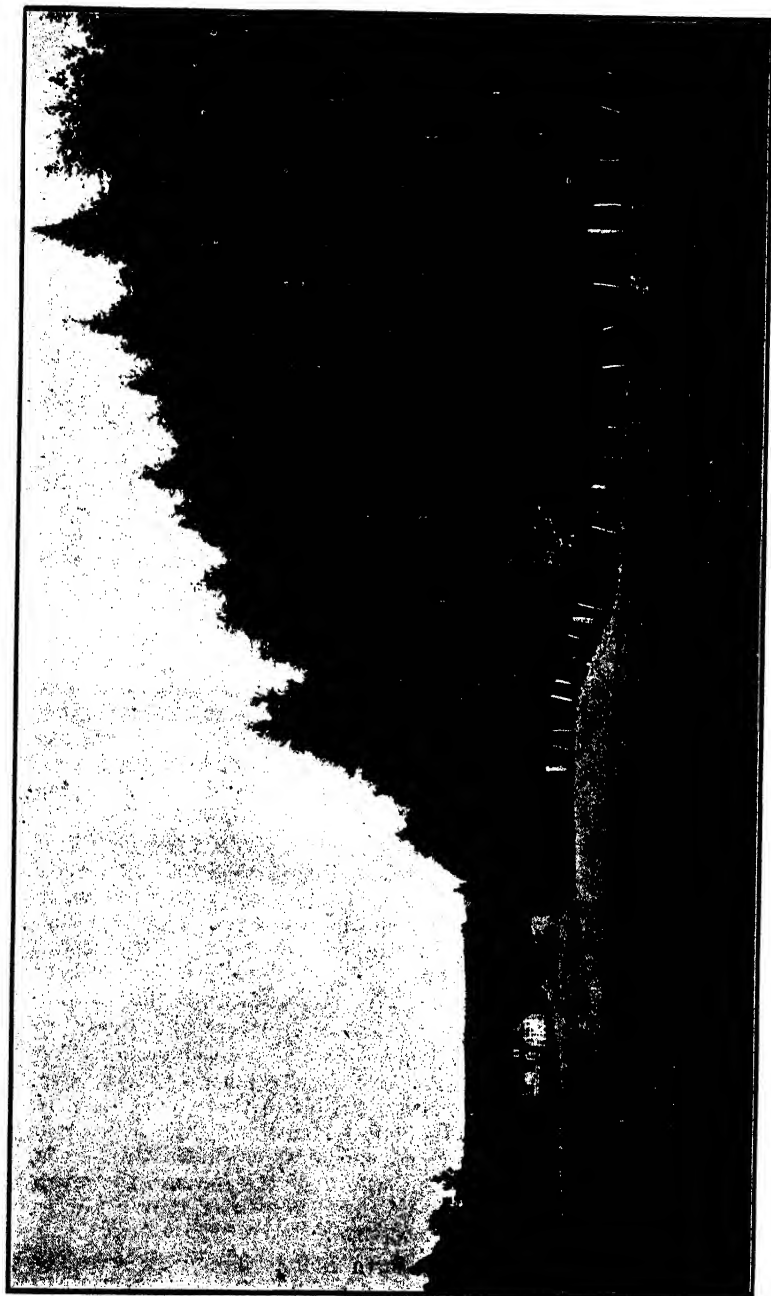
PINES (GENUS PINUS).

Botanists tell us that there are altogether over seventy species of *Pinus*, all indigenous to countries in the Northern Hemisphere. The late T. W. Adams, in a paper published in the "Transactions of the New Zealand Institute," Vol. xlviii, 1915, and separately issued in 1916, mentions fifty-six species as having been experimentally introduced into this country. The following species were noted by the writer as growing at "Homebush":—

Species recommended for General Planting.

Pinus insignis (syn. *P. radiata*).—Original home, Monterey, California. Tree a sturdy upright grower, usually with undivided stem and spreading branches. Leaves in threes, flexible, 4 in. to 6 in. long. Cones 5 in. long, broad near the base and abruptly tapered, heavy; each scale on exposed side of cone terminating in a rounded boss, which on some trees develops into a blunt claw. Of all the pines introduced into this country *P. insignis* easily holds the first place for rapidity of growth and quantity of timber-yield. The sawn product of a tree with a bole 9 ft. in average girth and 40 ft. long will be 2,430 superficial feet. At "Homebush" there are two or three trees each of which would exceed that amount. From sawmillers working in fairly well-planted stands of *P. insignis* between thirty and forty years old we hear what seem to be quite reliable estimates giving an average yield of 60,000 ft. per acre. On the quality and value of the timber for use in dry situations, or where it can be protected by paint, practical experts are gradually forming favourable conclusions. The big *P. insignis* trees at "Homebush" have for many years been scattering fertile seed, and some of their offspring are now lifting their heads far above surrounding vegetation. The example is one of many showing how soon nature would produce forests of this pine if parent trees were established in suitable situations.

Pinus ponderosa.—Original home, western North America. Tree erect, with undivided stem and horizontally spreading side branches. Leaves in threes, rigid, 8 in. to 10 in. long, dull dark green, mainly at ends of branchlets. Cones less abruptly tapering than those of *P. insignis*, 4 in. to 5 in. long; scales armed with slender prickles. The species has found congenial conditions at "Homebush," and is there represented by many millable specimens. The average for the best boles might be 7 ft. 6 in. in girth with 40 ft. in length, which would give a yield of 1,687 sup. ft. per tree. In its native home *P. ponderosa* has a very wide range—hence divergent forms. *P. jeffreyi* differs from the type in the pale blue-green tint of its foliage, in its more finely divided bark, in the larger size of its cones, and in the usually smaller dimensions of the tree. It appears at "Homebush" side by side with the true *P. ponderosa*. Mr. Deans is of opinion that he can also distinguish another form known as *P. Benthamiana*. The behaviour of the species in these plantations shows that it needs close planting to early suppress the side branches. We have not yet milled enough of the timber in New Zealand to form a judgment on its quality, but reports from America place it in a high grade. It is there known as the "western yellow-pine."



A VIEW AT "HONEYBUSH," CANTERBURY.

Mixed plantation on hillside, larch predominating; 20 years old; trees 50 ft. high, and up to 3 ft. in girth. Homestead (Mr. James Jeans's residence) in middle distance on left.

Pinus laricio.—Original home, Corsica and South Europe. Tree symmetrical, with undivided stem and branches going off horizontally in nearly regular whorls. Leaves in twos, 4 in. to 5 in. long. Cones 2 in. to 3 in. long, about 1½ in. in diameter; scales without prickles. In Europe this tree is considered a rapid grower, and has a high reputation for the quality of its timber. After full inquiry and considerable experiment our State forests officers have adopted it as a tree for extensive planting. Mr. John Deans, brother of Mr. James, has at "Kirkstyle," on another part of the original estate, specimens of *P. laricio* that are vigorous and beautiful, and give promise of reaching a good millable size within another fifteen or twenty years.

Species that cannot be recommended for General Planting.

Pinus pinaster.—Original home, Mediterranean region. Leaves in twos, thick, rigid, 7 in. to 10 in. long. Cones about as long as those of *P. insignis* but less in diameter, produced in whorls or clusters; scales with projections but without prickles. The tree has a strong tap-root system, but is weak in lateral roots. On the western coast of France, where it is so extensively planted for sand-dune reclamation, the tap-root can descend to a great depth and hold the tree up against the force of the wind. Planted on a gravelly subsoil or on a hard-pan where its tap-root cannot develop it becomes wind-swayed, and consequently makes a curved or crooked bole. In capacity for natural regeneration it surpasses all other pines known to us in New Zealand. Its well-winged seeds are carried far on the wind, and readily germinate and grow wherever sunlight can reach the surface of the ground. At "Homebush," as in so many other localities, a few parent trees have produced a thick crop of seedlings and saplings. If only this tree were of better form and its timber of higher quality there would be for it a very large place in our future forestry; but where and while we can grow the three pines mentioned above it must be excluded from general planting. Even on our coastal areas it is displaced by the more adapted *P. muricata* from western North America.

Pinus Coulteri.—Original home, coast range of California. Tree erect and of handsome form. Leaves in threes, thick, rigid, 9 in. to 11 in. long. Cones very large and heavy, measuring 9 in. to 10 in. in length and 4 in. to 5 in. in diameter; scales armed with very large and sharp-pointed claws turned mainly towards the apex of the cone; remain closed for a long time. Specimens at "Homebush" now about 50 ft. high are bearing cones. They are ornamental, but offer no prospect of a profitable timber crop.

Pinus Sabiniana.—Original home, foothills of California. Tree usually forked low down. Leaves in threes, pendent, 5 in. to 6 in. long. Cones very large and somewhat similar to those of *P. Coulteri*, but differ in being shorter and less tapered, in having the scale claws less acute and turned outward, in the much larger size of their seeds, and in readily opening to allow the escape of the seeds. The rather numerous specimens at "Homebush" have been overgrown by other conifers, and are of no value unless for fuel.

Pinus excelsa.—Original home, North India. Tree with spreading branches and drooping foliage. Leaves in fives, slender, flexible, 5 in. to 6 in. long. Cones pendent on tree, 6 in. to 9 in. long, narrow,

curved; scales when dry very light, marked on exposed surface with slight grooves. Pines with similar but shorter leaves and cones come from North America—*P. strobus* from the eastern and *P. monticola* from the western States. The distinction is not always easy. Trees in the "Homebush" plantations were noted as belonging to *P. excelsa*, but with some doubt. They had been partly suppressed by more rapid-growing trees, but were healthy and had produced cones in great abundance.

Pinus sylvestris.—Original home, North Europe. Tree a rugged erect grower. Leaves in twos, 2 in. to 3 in. long. Cones small; scales without prickles. This pine, though very valuable in Europe, has proved to be unadapted to our climatic conditions, and consequently subject to disease in many localities. There are a few fair specimens at "Homebush," but their size and rate of growth are insufficient to encourage further planting.

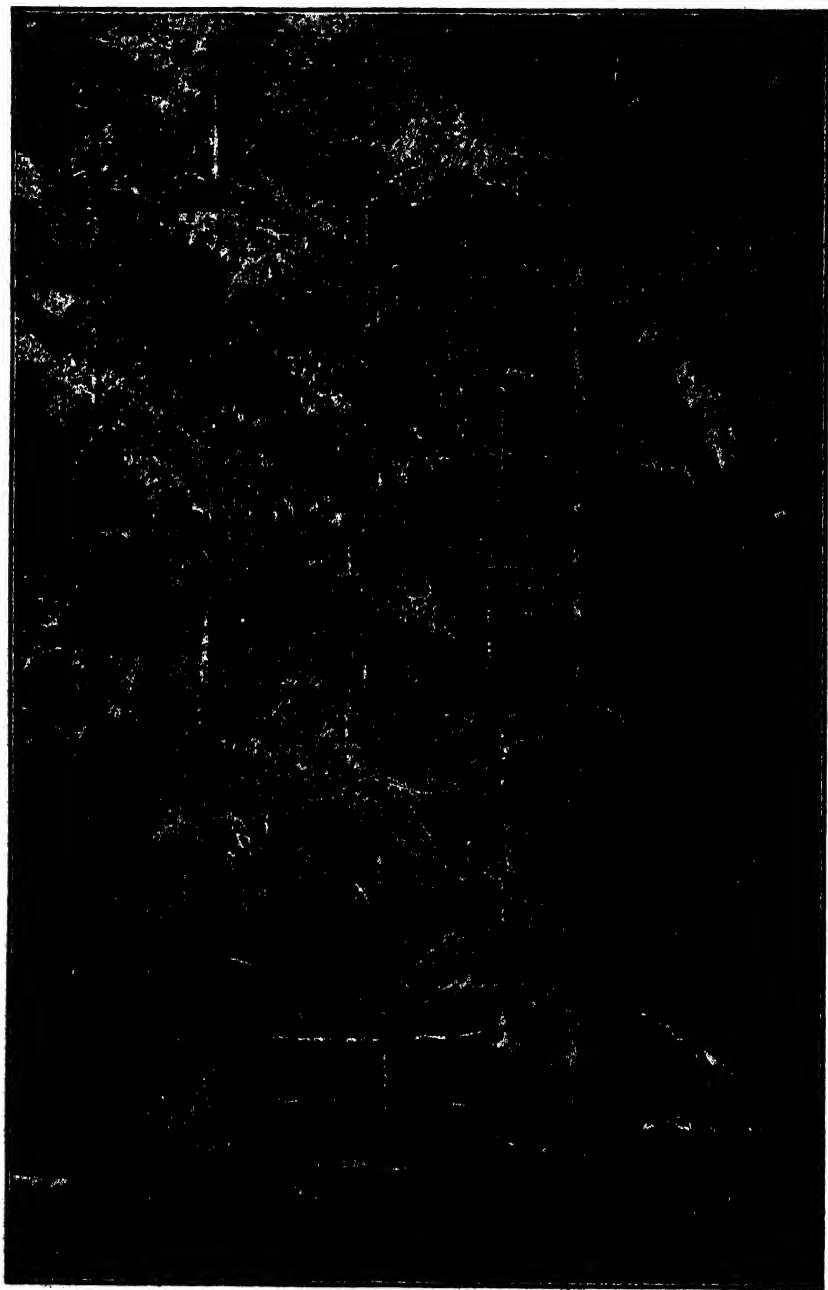
DOUGLAS FIR (GENUS PSEUDOTSUGA) (*P. DOUGLASII*; SYN. *P. TAXIFOLIA*).

Original home, an immense territory in western North America, the best variety or strain being that which grows near sea-level in the sheltered sounds and bays. Tree with erect stem and horizontally spreading branches and branchlets. Leaves somewhat yew-like, hence the second specific name *taxifolia*. Cones a rich brown colour, pendent on the tree, 3 in. to 4 in. long; scales thin but strong, each with an exposed three-pointed bract behind it. The species, though called a fir and resembling generally the firs and spruces, is neither a fir nor a spruce, but belongs to a distinct genus. It is the species that has yielded the exceedingly valuable "Oregon pine" timber of commerce. When propagated from the coastal variety it has found a congenial home over a very wide range in this country. The trees at "Homebush" are splendid. Mr. Deans calculates that he has 150 specimens that would average 4 ft. 6 in. in girth and 40 ft. in length of millable bole. A log 40 ft. long and 4 ft. 6 in. in girth midway between the two ends yields 608 ft. of sawn timber, superficial measurement. The 150 specimens are distributed amongst other trees over a great many acres of land. Had the species been planted pure, and properly thinned, it seems possible that there might have been seventy such trees on an acre of land. That would be 42,560 ft. of "Oregon pine" timber per acre in thirty-five to fifty years. Such a result in so short a period may be too much to expect unless in the most favourable conditions. This, at any rate, is certain: that *P. Douglasii* is a wonderful timber-yielder and perfectly happy in our country.

CALIFORNIAN REDWOOD (GENUS SEQUOIA).

There are two species of *Sequoia*. Both come from western North America. Both are world-renowned—one for the high merit of its timber, the other for its growth to huge dimensions of girth and height. Both are doing well over a wide range in New Zealand. Their prospective importance in our forestry is so great that we may well make their occurrence in the "Homebush" plantations the occasion for describing and commending them.

Sequoia sempervirens.—Tree erect, with horizontally spreading branches. Dead bark persists and ultimately becomes very thick.



SPRUCE PLANTATION AT "HOMEBUSH."

Including *Picea excelsa* and *Picea Sitchensis*. Trees 80 ft. high, 4 ft. girth; 35 years old.

Foliage yew-like. Cones at ends of branchlets, egg-shaped, $1\frac{1}{2}$ in. long. Timber pale red, easily worked, very durable. This is the species that has yielded the Californian redwood of commerce, the high merit of which is well known to all experts in timber. The tree needs a free subsoil and some protection against violent winds; otherwise it is very hardy. It often throws out sprouts from the base of the stem; and if broken or cut down it readily makes new growth. A rooted stump-sprout taken from "Homebush" and planted at "Kirkstyle" is now a vigorous sapling. When exposed to strong saline winds the growing apex of the tree will be cut back; but the writer has not noted a single specimen suffering from disease or premature decay. In Waikato, Wairarapa, Rangitikei, and Wairau trees have in forty to fifty years attained a girth of 9 ft. and a height of nearly 100 ft. In the State forests at Whakarewarewa, in the Botanic Gardens at Christchurch, at "Homebush," and in many other localities there may be seen younger and smaller but equally vigorous specimens. A log 9 ft. in girth and 30 ft. long yields 1,822 sup. ft. of sawn timber. On good land, with proper planting, protection, and thinning, there should be on an acre at the end of forty-five years at least thirty such boles. That would be a total ultimate product of 54,660 ft., to say nothing about the nurse trees and thinnings that would be removed and utilized meantime. *S. sempervirens* has sometimes been spoken of as the most valuable timber-tree in the world, and the evidence is strong for the conclusion that New Zealand could grow it in any desired quantity in many localities.

Sequoia gigantea (*Wellingtonia*).—Tree with erect stem, wide at base and rapidly tapering; side branches numerous but small and horizontally spreading. Dead bark persistent and ultimately very thick. Foliage and twigs somewhat like those of a cypress, but coarser and heavier. Cones at extremities of branchlets egg-shaped, 2 in. to $2\frac{1}{2}$ in. long. The species is represented by vigorous specimens in many parts of both Islands. In Canterbury, as we travel southward or rise to higher altitudes, it appears to have been more generally planted or to be better adapted to the conditions than its congener. The question of relative range is thus suggested for further inquiry and experiment. There are many specimens of *S. gigantea* at "Homebush." Where they have grown up amongst other trees they are tall, clean shafts crowned with vigorous foliage. A good many logs could be obtained 3 ft. to 3 ft. 6 in. in girth and 40 ft. long. The timber is inferior for technical purposes to that of *S. sempervirens*, but is said to be very durable in contact with the ground. Owners of trees should without delay have some of them converted into fence-posts for the purpose of testing this important question of durability.

CYPRESSES (GENUS CUPRESSUS).

Cupressus macrocarpa.—Original home, Monterey, California. Tree in typical form with spreading but not drooping branches. Cones large, as the specific name implies, but not larger than those sometimes produced by another cypress, *C. sempervirens*. Planted amongst other trees at "Homebush," *C. macrocarpa* has held its place and grown to a large size with a clean millable bole.

C. torulosa, *C. Lawsoniana*, and one or two other species of *Cupressus* in the "Homebush" plantations are healthy and vigorous but of smaller

dimensions. Nearly all the members of this genus have credit for yielding timber that will last a long time in the ground.

In the case of *C. macrocarpa* the durability of the heartwood when used as stakes and posts has been proved in this country by competent and repeated experiments. Farmers increasingly realize that they have in this familiar cypress a tree that is easily propagated, rapid in growth, effective for shelter, and capable of yielding at a very early age both high-grade fuel and long-lasting fencing-material. It will strengthen their appreciation to know that at "Homebush" and in many other places the species is freely reproducing itself under the parent trees.

CEDARS (GENUS CEDRUS).

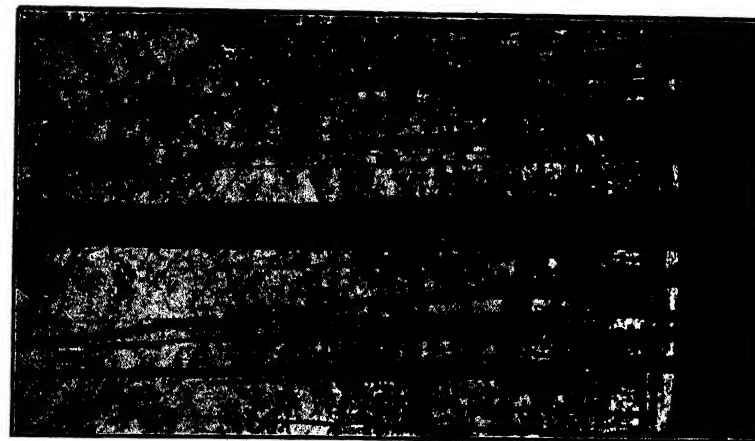
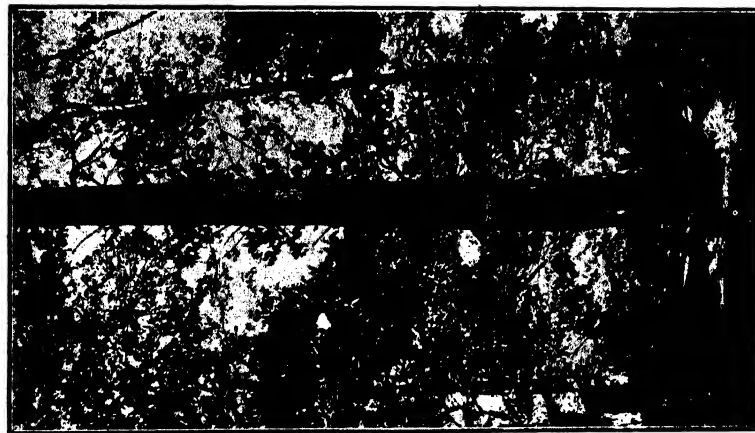
There are three species of *Cedrus*—namely, *C. deodara*, from northern India; *C. Libani*, from Asia Minor; and *C. Atlantica*, from the Atlas Mountains in Africa. The characters common to them all are horizontal or nearly horizontal spread of their branches, leaves in tufts, and firm egg-shaped cones carried erect upon the branchlets. *C. deodara* has the longest leaves and largest cones, and is remarkable for the manner in which its growing tips bend over and droop. *C. Atlantica* has the shortest leaves and the smallest cones, and is rigid in its habit of growth. *C. Libani* is intermediate in these respects between the other two. All are represented at "Homebush," but *C. Atlantica* easily holds the first place for number of specimens, vigour, size, and promise of timber-yield. Several trees have short boles large enough now for sawing into boards. Neither here nor elsewhere, however, does it seem probable that *Cedrus* will ever be a prominent tree in our forestry, unless one or other of the species should be found to produce a timber of much greater merit and value than any of the more rapid-growing conifers. The cedars are certainly very ornamental, and it is much to their credit that they can live and make good growth in exposed situations on the drier plains.

SPRUCES (GENUS PICEA); FIRS (GENUS ABIES).

These two groups are similar in general appearance, but may be distinguished by a study of their cones. The spruces carry their cones pointing downwards, and the scales hold together for a long time, so that perfect cones may often be seen lying about under the trees. The firs carry their cones pointing upwards, and the scales separate and fall apart as soon as the seeds are mature.

Picea Sitchensis.—Original home, western North America. Tree erect, with numerous side branches; bark scaly and rough. Foliage bluish-green. Cones under 3 in. long with thin scales. At "Homebush" this tree has nearly equalled *Pseudotsuga Douglasii* in rate of growth, but it does not present so clean and attractive a bole for the sawmiller. In the North Island and on the lowlands of Marlborough and Canterbury *P. Sitchensis* has grown rapidly for a few years and then declined in vitality. At "Homebush" there is evidence of the same tendency, but only to a slight degree. The inference, perhaps, is that the species requires a still colder climate and more moisture to be entirely beyond the reach of its enemies.

Picea excelsa.—Original home, northern Europe. Tree tall and erect, with rather weak side branches. Cones 5 in. long, narrow, firm, with



SOME BIG SPECIMENS AT "HOMEBUSH."

On left: *Cupressus macrocarpa*, 6 ft. 11 in. girth, 100 ft. high, estimated; 35 years old. In centre: *Pinus insignis*, 10 ft. 8 in. girth, 140 ft. high; 50 years old. On right: Douglas fir, 6 ft. 4 in. girth, 100 ft. high; 40 years old.

scales slightly notched at apex. The specimens at "Homebush" are amongst the tallest of the trees, but relatively very small in girth. This species also is failing on the lowlands, and probably has not yet found quite congenial conditions at 800 ft. above sea-level. Several specimens of *Picea* near the residence are understood to belong to *P. Smithiana*. They are healthy, and one of them is about 60 ft. high, with a girth of 4 ft.

Specimens of *Abies* in these plantations understood to belong to *A. pectinata* have reached a height of 75 ft., but are slender in girth. Others believed to represent *A. amabilis* are doing well after a somewhat slow start. The genus includes many species, and a wider range of experiment with them at this 800 ft. altitude would be of great interest and importance to future forestry.

LARCH (GENUS LARIX).

Larix Europaea.—Original home, colder parts of Europe. Tree erect, with rather weak side branches. Leaves in tufts, deciduous. Cones small, light. All trees that are not well clothed with foliage throughout the year are liable to be attacked in this country by fungoid parasites. Larch suffers from this cause as well as from other less obvious troubles. It can withstand its enemies and maintain vigorous life only when it has a cold climate and abundant moisture. At "Homebush" the conditions are a little too mild and dry for it. Mr. Deans finds that it has its best chance of success with him when it is planted in narrow belts alternately with other trees. The timber is light and strong, and useful for making gates.

INCENSE CEDARS (GENUS LIBOCEDRUS).

These are trees with dense foliage, and branches often arranged in a columnar or pyramidal form. The cones consist of a few leathery scales covering the seeds. They are similar to those of *Thuya*, to which the genus is related. Several trees at "Homebush," understood to belong to *L. decurrens*, have reached a fair size and are in good condition; but their rate of growth is too slow for profitable timber production. The kindred genus *Thuya* is represented by healthy specimens of *T. plicata*.

EUCALYPTS (GENUS EUCALYPTUS).

E. globulus (blue-gum).—Original home, Tasmania and south-eastern Australia. Tree too well known to need description. The species requires a deep subsoil and plenty of moisture. A few specimens at "Homebush" have found these conditions and are of gigantic dimensions.

E. viminalis.—Original home, south-eastern Australia and Tasmania. Tree runs up to great height, with straight stem; dead bark usually comes off, leaving smooth white surface. Leaves on young plants sessile, on older trees stalked, long, narrow. Buds and seed-cases in threes, rather small. Heart-wood fissile, straw-coloured; has lasted twenty years in the ground. There are at "Homebush" a few good specimens. The species should be planted where there is a free subsoil and plenty of moisture.

E. obliqua.—Original home, Tasmania and south-eastern Australia. Tree an erect grower with spreading top; dead bark persists on stem and branches and is fibrous. Leaves broad, unequal-sided. Buds pale, club-shaped, in clusters (umbels) of indefinite number. Seed-cases rather large, egg-shaped. Timber fissible, pale; very valuable for work above ground, only moderately durable in ground; good fuel. "Homebush" has a few large specimens.

E. amygdalina.—Variety with very narrow leaves. A few fair specimens.

E. Stuartiana.—Eastern Australia. Tree low and spreading. Dead bark persists and is subfibrous. Buds usually in sevens. Seed-cases top-shaped, three-celled. The species is of inferior merit and should not be further planted. A few specimens.

E. Risdoni.—Tasmania. Tree medium in size, often spreading and low. Dead bark comes off, leaving smooth grey surface. Leaves on young plants sessile; on older trees stalked, long. New foliage and buds glaucous. Seed-cases in clusters of indefinite number, broad top-shaped. Timber fissile, pale, said to be durable in ground. Two vigorous young trees were noted at "Kirkstyle."

E. regnans.—South-eastern Australia. Tree erect, rapid grower, ultimately very tall. Dead bark falls away from branches and upper stem, but persists on lower stem and is there fibrous. Leaves similar to those of *E. obliqua*. Buds in clusters of indefinite number. Seed-cases small, top-shaped, three-celled. Timber fissile, good for any work above ground. Vigorous specimens were noted near "Homebush" in one of the Selwyn Plantation Board's areas.

VARIOUS OTHER GENERA AND SPECIES.

OAKS (GENUS QUERCUS).

Quercus robur (English Oak).—Botanists describe two forms of this tree: (a) *Q. pedunculata*, with fruit-cluster on a long stalk and leaves on very short stalks; (b) *Q. sessiliflora*, with fruit-cluster on a very short stalk and leaves on longer stalks. Numerous good specimens at "Homebush" were noted as *Q. pedunculata*, but they were at the time bare of leaves and acorns, so that the question could not be positively settled.

ASH (GENUS FRAXINUS).

Several trees growing in a damp situation at "Homebush" have attained a fair size, and could now be sawn up for tool-handles.

POPLAR (GENUS POPULUS).

Populus nigra.—Tree with clean bole and spreading branches. A few specimens growing near water have reached a good millable size.

P. alba or *P. canescens*.—This tree spreads freely by suckering, and is liable to become a weed. A group at "Homebush" on damp ground presents many stems that might be sawn into narrow boards or into fencing-droppers. Had the same ground been planted with *Eucalyptus regnans* the result would have been a heavier crop of better timber.

P. fastigiata (Lombardy Poplar).—This well-known tree is very ornamental, but as a timber-yielder much less valuable than *P. nigra*.

HORNBEAM (*CARPINUS BETULUS*).

This tree merits a welcome place in the arboretum, but as a timber-yielder it is small and relatively of low value.

CONCLUSION.

The man who understands trees and puts a right value upon them knows when to cut down as well as when to plant. There are few plantations of any considerable size and age that do not need the woodman's axe and saw. Some trees should be removed because they are defective as individuals or because they belong to inferior species; others because they are at the best stage for repaying the cost of planting and subsequent maintenance. Mr. James Deans has the instincts of a true forester. He knows his trees, and has read a great deal about their botanical history. He is well aware that many specimens in his plantations should as soon as practicable be converted to use. A circular saw, driven by a turbine water-wheel, awaits the task of cutting these trees into fuel or into boards and scantling. Many logs have already been sawn up. Domestic fires have been supplied, fence-posts renewed, and buildings repaired with the product. Where there are so many trees the removal of a few only leaves the conditions better for those that remain. Then also there comes the opportunity to under-plant with more valuable species.

Nature intended New Zealand to be the home of many forests and its inhabitants to be a tree-loving people. The forests planted by Nature's own hand were great and beautiful; but those that are to be planted by the hand of man, with Nature's aid and blessing, will be equally beautiful and more productive. A study of exotic forestry at "Homebush" and elsewhere north and south discloses this interesting truth: that the most promising of the trees yet introduced, with one or two exceptions, are the conifers from western North America and the eucalypts from eastern Australia and Tasmania. Our forests of the future will include the best of our own indigenous trees and the best and most adapted trees from all other temperate countries. The writer's belief and hope is that New Zealand will then not only supply its own needs, but export large quantities of timber to other markets.

State Nurseries and Plantations.—The annual report of the Forestry Department states that during the year ended 31st March, 1920, trees to the approximate number of 11,724,000 were raised in the four State nurseries, and during the same period 3,710,900 trees were sent out to the various plantations of the Department. The area planted in both Islands totalled 1,972 acres. This area is less than the average, and is accounted for by the fact that, owing to an adverse season at Tapanui, there was a much reduced number of trees for planting out on the plantations supplied by that nursery. The total area now planted in both Islands is 37,416 acres.

WORK FOR THE COMING MONTH.

THE ORCHARD.

REPORTS which have come to hand through shippers from their agents in England relative to the quality and condition of last season's export shipments of apples have varied to some considerable extent. On the whole they were quite as good as expected under the conditions. Some were highly flattering, complimenting us on the appearance, pack, flavour, and condition of our fruit on arrival, and saying that it was better than the best Australian to date. The fruit readily sold at top control prices. Although satisfactory, this may not be taken, however, as definite assurance that the whole arrived in the condition we should have desired. Shortage of supplies at the time may to some extent have accounted for its ready sale, not entirely the merit of the fruit itself.

The most critical report, although it does not condemn our fruit in so many words, goes rather too close to doing so in effect to be altogether comforting—by offering suggestions calculated, in the opinion of the reporter, to considerably improve our future shipments. Apart from minor criticisms the principal one was regarding overmaturity of a proportion of the fruit on arrival. This we fully expected, and are quite ready to admit as being possibly the case. The reporting agent, however, being made acquainted with the fact that the fruit was packed under recently introduced grading regulations calling for certain colour standards, has, in my opinion, erroneously jumped to the conclusion that such overmaturity was due to growers having to defer picking too long in order to allow the fruit to take on that degree of colour required by the regulations.

The remedy suggested by the critic is to pick our fruit green with little or no colour showing, and he claims that such fruit will colour up sufficiently in transit, and will otherwise arrive in a much more suitable condition for sale on the English market. This may be so, but it will be a great pity if such an expedient has to be resorted to. Every grower of experience knows what to expect of immature fruit, such as that described, after being held some two months in cool storage. At best it will be sickly and insipid in colour and flavour as compared with what it should be. If circumstances eventually compel us to ship fruit in the condition suggested it will, of course, have to be done, but the prospects of building up a name and demand for our fruit on European markets will be anything but bright. However, I do not for a moment think that we will be reduced to anything like this condition, the opinions of the English agent notwithstanding.

It must be taken for granted that a proportion of our apples did arrive on the English market in an overripe condition. It is unfortunate that it was so, but, on the other hand, it is fortunate from the point of view of our future apple trade that there were definite reasons for expecting this which were possibly not known or not appreciated by the writer of the report in question. The reason was connected with the unavoidable confusion experienced here during the shipping season through the late allotment of shipping-space, and the uncertainty of space and supplies of fruit—one largely creating the other—with the result that fruit which came to hand was shipped altogether out of its proper rotation and in some instances much beyond its season. A proportion of Cox's Orange, for instance, was shipped over five weeks after being packed. Again, Jonathans, the last of which variety should have been shipped on the "Port Napier," were largely despatched later by the "Corinthic," owing to growers not being in a position to give assurance of their ability to pack them in time to allow another chamber of 16,000 cases to be secured on the "Port Napier." Many of the Jonathans shipped by the "Corinthic" were overmature and too large to suggest an ideal

carrying-condition. These instances alone are sufficient to account for all over-maturity criticisms, but in neither instance was that overmaturity due to holding the fruit too long in order that its colour might comply with the requirements of the regulations.

As regards future shipments, there is little doubt that few instances will be found of fruit carrying the colour requirements of the "Fancy" grade (where fruit colours at all well) having any more than reached that maturity required for shipment, particularly in view of the slight adjustments which are being made with reference to Cox's Orange and other striped varieties.

Apart from our general experience of the keeping-qualities of fruit, the foregoing view is to some extent confirmed by the result obtained with fruit shipped by the Department to the High Commissioner, London, for exhibition purposes. This fruit before being packed had developed colour in excess of that required by the "Extra Fancy" grade, and it also represented the only lot of fruit relative to which an individual knowledge was available before shipment and on arrival. The fruit in question was reported by the High Commissioner to have arrived in first-class condition and was awarded the highest award at the Cardiff Show.

—J. A. Campbell, Assistant Director of the Horticulture Division.

AUCKLAND.

There are indications this season of a heavy crop of both apples and pears. Stone-fruits are, generally speaking, above the average in regard to crop, and the picking of the early-ripening varieties will be demanding the attention of growers about the middle of the month. Apples will follow in close succession, and, as all available time will then be taken up to a very great extent in the successful harvesting and marketing of these crops, it is imperative that such work as seasonable cultivation, including disking and harrowing, the disbudding of young trees, and the thinning of pip-fruit crops should be pushed on with all speed.

Fire-blight: As indicated last month, the Department is desirous of obtaining all information possible regarding the outbreak of fire-blight in any particular domestic or commercial orchard, and asks any person who discovers what he considers to be suspicious symptoms of this disease to immediately communicate with the Orchard Instructor for the district in which he resides. Although a thorough inspection for this disease is being undertaken, it will be recognized that there will still be a possibility of small infection being missed, or occurring after the visit of the Inspector, and it is hoped that the assistance of all growers will be enlisted.

Spraying summary for the month—Apple, pear, and quince: Arsenate of lead, $\frac{1}{2}$ lb. powder or $1\frac{1}{2}$ lb. paste to 50 gallons water, for the control of codlin-moth, every fourteen to twenty-one days, together with commercial lime-sulphur, 1-90 to 1-100, for the control of fungoid disease.

Peach, nectarine, and plum: Growers are advised to spray with commercial lime-sulphur, 1-120 to 1-125, as a preventive against brown-rot.

Citrus fruits: Bordeaux, 4-4-40, as soon as the fruit has set on the main crop of flowers. Citrus growers are again reminded of the necessity of removing all wood injured by frost during the winter, otherwise it may lead to fungoid trouble or give opportunity for the entry of borer insects.

—J. W. Collard, Orchard Instructor, Auckland.

HAWKE'S BAY.

Ground work: Continue cultivation to break the earth-crust and kill weeds.

Young trees: Useful tree-formation work can be done now by removing surplus and misplaced shoots, but this work should not be carried to excess, or the trees are likely to suffer from the removal of too much leaf surface. Where grafts have failed to take, a well-placed stock growth should be allowed to remain and budded over in season.

Thinning: Young trees up to four years should have all the fruit removed. Where apples and pears have set a heavy crop the fruits may be thinned to advantage. Particular attention should be given to weak-growing trees, and all fruit on the upper parts of the leaders removed. In no instance should fruit be allowed to remain on last season's leader-growth. Stone-fruits will also need attention; endeavour to have each variety thinned before the stoning-period; fruits should not be left touching each other, as brown-rot usually commences at such places.

Spraying: Apple, pear, and quince—For moth, leech, and leaf-roller, arsenate of lead, 1 lb. powder or $1\frac{1}{2}$ lb. paste to 50 gallons. For red mite, scale, mildew, and black-spot, lime-sulphur, 1-100. For woolly aphis, Blackleaf 40, 1-800. If black-spot is troublesome use bordeaux 3-4-50.

Plum—For leech, arsenate of lead, as for apples. For brown-rot and rust, lime-sulphur, 1-120.

Peach and nectarine—For brown-rot, lime-sulphur, 1-120.

Fire-blight: Keep a lookout for dead spurs or twigs on apple, pear, or quince and report at once to the Orchard Instructor.

—W. H. Rice, Orchard Instructor, Hastings.

NELSON.

The notes supplied last month regarding orchard spraying and cultivation, also the thinning of the fruit and "stopping," still hold good and are the most important operations for December.

The orchard harvest will commence about the middle of the month with the stone-fruit. To successfully meet the attacks of brown-rot to which this crop is so liable it is necessary to carefully collect infected fruit and properly destroy it. Search the trees weekly while the crop is about. This, together with the lime-sulphur summer spraying, has given very encouraging results.

—W. C. Hyde, Orchard Instructor, Nelson.

CANTERBURY.

Pests and diseases of pip-fruits: At the time of writing powdery mildew has made its appearance in the district. Growers should lose no time in spraying with either atomic sulphur, 10 lb. to 100 gallons, or lime-sulphur, 1-100. As an additional measure of control pick off and burn all affected twigs.

Black-spot is in evidence on early susceptible varieties of pears. All trees should be resprayed with lime-sulphur, 1-100, or bordeaux, 3-4-40. For codlin-moth, pear-slug, and leaf-roller, spraying with arsenate of lead (paste 3 lb. or powder $1\frac{1}{2}$ lb. per 100 gallons) should be continued. Apple leaf-hopper and red mite are again prevalent. Apply Blackleaf 40, 1-1,000, or lime-sulphur, 1-100. 3 lb. of soap per 100 gallons of Blackleaf 40 improves the mixture. When soap is added to the Blackleaf 40 do not combine arsenate of lead with the mixture. The spray should be directed to the under-side of the leaves. Repeat the application at intervals of three weeks until pests are got rid of.

Pests and diseases of stone-fruits: In all orchards where red mite and black aphid are present the affected trees should be given a thorough dressing of either Blackleaf 40, 1-1,000, or lime-sulphur, 1-125. **Cherry-slug.**—Before picking, hellebore powder is recommended to control this pest; after picking, where necessary, spray with arsenate of lead. **Brown-rot.**—As a precaution against this disease thin out fruits so that no two touch one another. Spray at intervals of from fourteen to eighteen days with either atomic sulphur, 10 lb. per 100 gallons, lime-sulphur, 1-125, or bordeaux, 3-4-40. Pick and burn all fruit showing signs of infection.

Bladder or pocket plums: This disease is troublesome this season in some parts. Pick off and burn all infected fruits and twigs. Spray with lime-sulphur, 1-125, or bordeaux, 3-4-40.

Silver-blight-infected trees are numerous this season in some localities. Cut out and burn all dead limbs and branches.

Grafts: These will have to be regularly attended to now. Remove all shoots and buds below the graft.

Disbudding: Remove from the roots and trunks all superfluous shoots, so that the energy of the trees will be directed toward the development of leaders and laterals. In young trees surplus and misplaced growth which would have to be cut out at winter pruning should now be carefully removed.

Thinning fruit: In nearly every orchard trees will be found which are carrying a heavy crop of fruit. By the time these notes appear practically all danger from frost should be gone, and it will not be too late to carry out this important work. Thin out sufficiently to give remaining fruits ample room for development. Remove damaged and diseased fruit. All fruit should be taken off towards the tops of leaders of young trees.

Marketing: Neither apricots nor peaches should be allowed to become over-ripe before being sent to the market. As a matter of fact, they should be packed slightly on the green side, as usually a few days elapse before they reach the consumer. By that time they are about in a condition for use. When purchasing

a new supply of cases order the Government-standard-sized cases. Stencil your registered brand legibly on the end of each case. The Government official grade marks, Extra Fancy, Fancy, and C Grade, are to be used only to describe fruits graded and packed according to the standards set out in the regulations.

Cultivation: At this season of the year orchard cultivation should receive special attention. Every effort should be made to reduce the soil to a fine tilth to a depth of about 3 in. in order to conserve the soil-moisture during dry periods. The soil should be stirred after rains as soon as sufficiently dry to work. A hard crust should never be allowed to form.

—W. K. Dallas, Orchard Instructor, Christchurch.

OTAGO.

At time of writing the weather is hot and dry, an indication of an early summer and probably a dry one. Where cultivation is not up to a good standard lose no time in attending to this work, a good dry mulch being the best retainer of moisture.

Fruit-thinning will still be in full swing. Pay particular attention to small varieties of apricots, such as Newcastle, thinning out the scabby ones. The result will be greater weight and better quality. Muir and Triumph peaches pay well for careful thinning out, also Burbank plums. Among apples, Scarlet Nonpareil requires special attention, for the trees' sake as well as the crop. All young apple-trees should have the fruit removed from the previous season's growth so as to give the leaders a chance.

Do not wait till you see the effects of codlin-moth. Spray now with arsenate-of-lead powder, $1\frac{1}{2}$ lb. to 2 lb. to 100 gallons, or paste, 3 lb. to 4 lb. to 100 gallons, and follow it up three weeks later at the longest. Fight woolly aphis from the start if you want the best results, using Blackleaf 40, at 1-800. The same applies to black and green aphis on peach-trees. Keep lime-sulphur or atomic sulphur going where fungus diseases are likely to be troublesome. Reference to previous notes will supply all information on these diseases.

—J. H. Thorp, Orchard Instructor, Dunedin.

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

MANAGEMENT OF GROWING STOCK.

A MATTER for the poultry-keeper's first concern now is to see that the young stock are fed and managed in such a way as will enable them to make steady growth and healthy development. Where possible the pullet that is about half-grown should be given a free range, as this is one of the secrets of building up desired size and a vigorous constitution. Of course, hand-in-hand with this, good comfortable housing should be provided. This should be draught-proof, but at the same time it should be arranged in such a way that fresh air is available to the chickens at all times. That is to say, while the house must be well opened up in front, there must be no cracks in the sides or back walls. Never forget that compelling a bird to sleep in a draught is the most common cause of colds, which are forerunners of that dreaded disease roup. Generally speaking, a bird is better roosting in a tree than in a house in which the wind whistles through all parts. In addition to being draught-proof the house should be kept in a thoroughly clean condition. Above all, do not overcrowd, or the trouble thus invited may be expected sooner or later.

Exercise is another matter that must not be overlooked. Where roomy outside runs are provided or the birds are allowed a free range these conditions will provide ideal exercising during fine weather. Something more is required, however; the floor of the house should be covered with litter in which some grain food is fed. This will induce the birds to exercise in comfort during unfavourable weather conditions. Some people keep their well-grown pullets in small coops, with merely enough room for the birds to stand up in. This means that when long spells of wet and cold weather prevail the young birds are forced to go out-of-doors and become wet through, or remain under cover where the conditions are anything but what they should be. In such cases it is little wonder that diseased and unthrifty stock are the result.

The next essential in securing profitable and vigorous stock is to see that an ample supply of good but non-forging diet is provided. A moist mash made of two

parts bran to one part of wheat-meal, or the usual pollard-and-bran mash, should be provided for the morning and midday meals, while crushed plump oats (Sparrow-bills preferred) or broken wheat, maize, &c., should form the evening meal, and be fed in a manner that will encourage the birds to scratch and keep busy. In addition, it is always a good plan to have a dry formula of pollard, bran, ground-wheat, &c., in a separate hopper, and left always before the birds to pick at. Some people give their growing stock dry food entirely, while others give all wet mash except for the evening meal. Both systems have their advantages, but to the writer's mind a combination of both the wet and dry systems will usually give the best results. Then, for stock of all ages a liberal supply of green food is an essential. Indeed, it is safe to say that a growing bird cannot make the best growth if it is stinted of green material at this period of the year. The same may be said in regard to shade, as neglect in this connection is a common cause of chickens making slow growth during hot weather. As a means of assisting digestion, the birds must have grit available to them at all times. It should be remembered that fowls have no teeth, the grit acting in their place, and unless this is always in reach of the birds indigestion and other troubles are bound to follow. Do not neglect to clean and fill the water-fountains daily, as drink is of equal importance as food during hot weather.

It is the present growing pullets that must be looked upon to produce the dear eggs next winter, and if a maximum number of the latter is to be secured it is imperative that the birds be fed and managed to the best advantage during all stages of their development.

BROODY HENS.

In these days of dear foodstuffs it will mean a continual drain on the profits of the poultry-keeper if broody hens are allowed to sit on the nests for days at a time. The day has gone by for considering that the hen is all the better for a natural rest. This not only means a loss in eggs, but the breeding of insect pests is encouraged. Broody hens should be removed from the nest and placed in a broody-coop immediately they show the first desire to sit. It should be remembered that the longer the bird is allowed to sit on the nest, the longer will it take to lose the broody fever. Do not adopt the foolish policy of starving the broody hen; on the other hand, give her as much food as she can eat, in order that egg-laying may be resumed in the shortest time possible.

COCKERELS FOR BREEDING-PURPOSES.

With little or no culling having yet been carried out, and the young stock rapidly gaining in size, the plants of many breeders will fast become overcrowded. To lessen the risk that usually follows, it is now full time that the early-hatched cockerels be gone through, selection made for future breeding purposes, and the rejects got ready for market. In choosing the breeders it is always a wise policy to reserve more birds than are actually required, so that when the final selection is made only the best specimens are retained for future service. Do not forget that very often a cockerel may look ever so promising during the growing stage, but will prove disappointing when mating-time comes round. On the other hand, it will be frequently found that a bird slow to exhibit desirable characteristics makes an outstanding male when fully developed. As a general rule, the cockerel that shows signs of very early maturity, and which is the first to catch the eye in a flock of birds of the same age, seldom or never grows to a desired size, and therefore will never make a desirable sire. In most cases it is the cockerel of fair size and slow to mature, but good on breed-points, that is the most likely one to attain a good size of body and subsequently produce robust stock.

THE APIARY.

G. V. WESTBROOKE, Apiary Instructor.

DURING the coming month all preparations for the honey crop should be pushed forward. The main flow lasts from ten to fourteen days, depending largely on weather conditions. It is therefore necessary to have the colonies in good condition, with the maximum number of field-bees, and everything in readiness for the rapid storing of the nectar when it is available.

Those who use queen-excluders, to prevent the queen ascending and laying in the combs in the supers reserved for honey, should now place them on the hives.

This operation should be done, as far as it is possible to judge, about two or three weeks before the main flow commences. The best results are obtained by lifting all frames of brood—except the one holding the queen—up to the super, filling up the vacant space in the hive-body with clean empty combs or frames fitted with full sheets of foundation. Place the excluder on top of these between the bottom box and the super. An extra super may also be placed on the top. As the bees hatch out above the excluder the cells will be filled with honey. In about seven days it will be necessary to look through these frames to see if queen-cells have been started. If any be found they should be torn down, unless queens are desired from that particular hive. Once the heavy flow is on there will be little danger of swarming.

Should the weather become very hot it is advisable to lift the front of the hives on small blocks of wood so as to raise them about 1 in., to allow plenty of ventilation. Some beekeepers prefer to place the super so that it projects about 1 in. over the one below. This not only allows free ventilation, but gives the field-bees an additional entrance, which is a decided advantage in a strong colony during the heat of summer. Care must, however, be taken to close these outlets as soon as the flow ceases, otherwise there would be a danger of robbing.

From now on for the next two or three months beekeepers will be kept very busy. It is therefore important that they should have a full stock of frames ready wired and filled with foundation, unless they have a large supply of clean empty combs.

INTRODUCING QUEENS.

Those who have ordered early will now be receiving their new queens from the breeders. When these arrive take care to see that they are kept in the shade until required. When first received from the mail, take off the address-card carefully and ascertain if the queen is alive. If she should arrive dead post back the cage intact, and the supplier will usually replace it with another.

Before introducing the queen into a hive make sure that the colony is queenless. It is best to hunt up and kill the queen to be replaced just before introducing the new queen, as a hive that has been queenless for some time will often refuse to accept a new one. Before placing the cage in the hive see that the hole containing the candy is covered only by a small piece of cardboard. This is placed there in order to prevent the bees releasing the queen too quickly. In about twenty-four to thirty-six hours the bees will have eaten through the cardboard, tunnelled their way through the candy, and so left the way clear for the new queen to emerge. By this time they will have become used to her and will usually accept her. After introducing the queen do not open up the hive for at least a week, except for the purpose of quietly removing the cage on the third day if the queen is out. If they have failed to give her an exit by that time, push a stick or pencil through the cage and quietly replace and leave alone for a week.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

TOMATOES: When these notes are published all planting should have been done, and in most cases the plants should have made a fresh start. Spraying should in most cases be regarded as a matter of ordinary routine and should be commenced before there is an appearance of disease. Prevention is easier and better than cure, so a beginning should be made at once, and the spray repeated at intervals of about fourteen days. If heavy rain follows soon after spraying repeat it as soon as the weather is fine. Bordeaux, 4-4-40, may be used, or in place of the 4 lb. of lime use 6 lb. of washing-soda. When the plants begin to grow they immediately push out side shoots. The number of these to be retained will depend on the system of training. If the plants are to be confined to single stems all the side shoots should be pinched off; if to two stems the strongest or best placed

on each plant should be kept. In that case do not hurry to tie the plants to the support, for if they are allowed to bend over the side shoots will advance more rapidly and soon overtake the original leader. The question of fertilizers is a very difficult one, and one on which authorities greatly differ—so much so as to be in some cases in exact opposition. The fact is, of course, that the fertilizers required must to a very large extent be ruled by circumstances, the class of soil, what is in it, and the natural climate. It is agreed generally that the chief requirements of the plant are phosphoric acid, supplied by superphosphate or bone manures; potash, supplied by sulphate or muriate of potash; and nitrogen, supplied by sulphate of ammonia or nitrate of soda. Some growers use blood-and-bone, in which case great caution should be exercised in the use of the nitrogen compounds, for though blood manure is slow in action, if it is applied early—as it usually is—it must become available during the main fruiting-period. The great difference between sulphate of ammonia and nitrate of soda is that the former is slow-acting—it becomes available only by degrees. This compound should therefore be applied early and in one application. Nitrate of soda is immediately available, therefore should be applied only to the growing plant and in small amount. Anxiety to produce growth may lead to a too free use of a nitrogen compound. This should be avoided. Too much nitrogen will produce a luxuriant plant, but it will decidedly delay the maturing of the fruit. Another evil is that it causes a soft growth that is very susceptible to disease. Both evils can to a great extent be counteracted by a proportionate use of potash. The following formula represents the average opinion as to what a tomato-fertilizer should be: 75 lb. nitrate of soda, 200 lb. 16-per-cent. acid phosphate (or 150 lb. steamed bone-meal), and 80 lb. muriate or sulphate of potash, per acre.

Cauliflowers should have been sown about the middle of September. This being an important crop the plants should have special care. It pays to lift the young plants and prick them out about 4 in. apart in a bed of good soil. The plants should be ready to put out finally by the last week in December. The heads come in before the earliest broccoli, and when peas and French beans are over. It pays to treat broccoli-plants in the same way. Properly speaking, the last broccoli-seed should be sown by the end of November, also cabbage and savoy. Broccoli-seeds, however, can be and often are sown later. Such late sowing is, however, only a makeshift, and the result is very uncertain, except that it is certain that only small heads can be got. In the warmest districts it is not very necessary to grow broccoli, except perhaps the earliest, as cauliflowers can be got very early in spring.

Brussels sprouts should be ready for planting out. The best results are got from plants that have a long season of growth. Questions are asked as to whether the leaves on the stems of brussels sprouts should be cut off. The answer is decidedly No. The sprouts cannot develop without the leaves, which should not be taken off until they turn yellow. Plants illustrated in trade catalogues have been denuded of leaves for the purpose of taking the photograph.

Provision for the winter supply of carrots, parsnips, and red beet should be no longer delayed. Silver-beet is very useful in case of failure or short supply of cabbages. It is also useful for poultry. If sown now the plants will be fully developed before winter. The plants sometimes stand for two years. Sow in a small patch and transplant, or in drills and thin to about 12 in. each way. Sow more peas, French and butter beans, turnips, lettuce, and radish. Lettuce should be sown in drills and the plants thinned instead of transplanting. Onions for pickling should be sown at once. Directions were given last month.

Celery: Where the leaf-disease has been experienced spray with 2-2-40 bordeaux every second week, so as to keep the foliage practically covered with the mixture. In cases where spraying has been done from the early stages little or no trouble has been experienced, but once a plant becomes seriously affected it cannot be saved. In the warmer districts celery, and also carrots and parsnips, are frequently attacked by tiny plant-lice. These insects are so small that they usually escape notice until the foliage begins to turn yellow and causes examination. Injury is done by the insects sucking the juices of the plant, and they can very quickly ruin a crop, even in the case of young plants, killing them outright. Spraying with Vistolene or XI-All fluid through a fine nozzle is a sure cure.

Potatoes should be sprayed as a prevention of blight. There is little doubt that if disease-free sets were planted on clean ground and a spray of 2-2-40 bordeaux—half the strength usually employed—given at frequent intervals from the

commencement of growth, disease would rarely appear. When, however, spraying is left until disease is evident the stronger mixture must be used.

Thinning all such crops as require it should be done as early as possible. Thinning is easiest accomplished while the seedlings are small, and the crop is the better for the early thinning. Moulding-up such crops as require it should also be done fairly early. The chief use of moulding-up most crops is to prevent injury by wind. In the case of dwarf beans it is best done in two operations, but cabbages and the like may stand longer. It is usually possible to make the moulding serve a double purpose by performing the operation when weeds require attention. The weeds are cut out or smothered without separate attention. Potatoes require at least two mouldings, the first to support the haulm, the second to ensure the tubers being well covered with soil. Where the potato-moth is troublesome special attention should be given to forcing the soil well among the haulm. The operation of moulding usually leaves a kind of trough along the ridge in which the haulm is standing. This trough should be filled so as to keep the moths from the tubers as far as possible.

SMALL-FRUIT.

Strawberries: The earliest runners should be cut off, the first consideration being the fruit. When the main crop has been gathered there will be time enough to make runners. It is usual to let runners root only in certain rows, which need not be trodden on. The runners are often allowed to make too many plants. This haphazard way results in a great number of the plants being too small to bear a good crop the first year; good plants alone can do so. The runners should not be allowed to make more than two plants each, and no more should be allowed on a plant than can have room for fair development. To allow the plants to make a mat is to produce weakly runners, and also to weaken the parent plants and lessen the next crop.

Raspberries: Keep the soil between the plants well cultivated, so as to suppress weeds and suckers. A sharp spade or strong hoe should be used to grub suckers between the stools.

Gooseberries and red currants: Bushes should be looked over and any gross young shoots appearing at the base or in the centre should be broken off; a downward tug will fetch them out at the heel.

Black currants: The plants should be allowed to push up a few new shoots from the base, but not more than are wanted should be left, as if the bush is crowded the buds cannot mature. The fact that the black currant bears fruit on the previous year's wood is the cause of some error in treatment. The fact is that the fruit on the young wood is supplementary to the main crop which the older wood should produce. In Europe, and even in the southern parts of New Zealand, it was formerly the custom to spur-prune the black currant, also the gooseberry, in which case, of course, all the fruit was produced from old wood—and very fine crops too. In these days a different method of pruning is adopted, by which a certain amount of the crop is taken from young wood, and this applies alike to gooseberries and black currants. Certain bad effects were produced by close spur-pruning; for one thing there was the production of a large number of shoots that required stopping in summer, giving needless work. In all but the coldest parts of the Dominion this close pruning and summer stopping led to crippling the plants, which became enfeebled, and many died. These evils were prevented by allowing greater freedom in the young wood, and healthier trees resulted. But still the fact remains unaltered that most of the fruit is borne on the old wood, or, rather, on spurs and shoots on the old wood. Therefore the interior of a bush must not be crowded. If it is there will be but part of a crop, and that will be mostly on the young wood on the outside of the bush.

Red currants: These do not bear on the young wood, but only on spurs on wood that is at least two years old. The aim of the grower is therefore to form an open bush, so that light can reach every part. The exact plan of bush matters little, but no doubt the open cup form is best, as it produces a system that can be followed. Main branches are led up in the usual way. All side shoots are shortened; first when they have grown about 12 in. they are reduced to 6 in.; this is, of course, during summer. Finally, in winter these shoots are cut back to short spurs about $\frac{1}{2}$ in. long. Note that the first shortening should not be more than stated. If it were it would cause the basal buds to break into wood-growth and the fruit-spur would be gone.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

POISONOUS HONEY.

H. F. M., Matata :—

I would like to know if there are many flowers which yield poisonous honey. Rangiora scrub is abundant here, but I believe that in its case the poison evaporates. However, there are said to be other plants much worse in their action, and I have heard a small yellow swamp-flower blamed, but do not know if this is correct. There have been several cases of severe poisoning in the district, one at Waimana being fatal, and the advice usually given is, "Do not touch wild honey." But there cannot be any difference between wild and apiary honey where scrub (not bush) is so abundant. Some say that if the honey is sealed it is safe, while others disagree. Can you give me any definite information?

The Horticulture Division :—

What is presumed to be the most common plant from which poisonous honey is gathered is *Brachyglottis repanda*—commonly called (but wrongly so) "rangiora." This plant should be called "wharangi-tawhito"; it is common in the northern districts. *Brachyglottis rangiora* is common in the northern portion of the North Island; it is also found in the South Island, and is correctly and commonly called "rangiora." They are of the same family, but rangiora is certainly the more handsome plant. *Ranunculus rivularis*, commonly called "waoriki," is a swamp-buttercup with a yellow flower, and this plant also yields a poisonous nectar in the flowering season. It is gratifying to know, however, that all the poisoning cases which have been investigated have been due to eating the honey in the spring before it has been ripened by the bees, and no cases have been known when only ripe or capped honey has been used. This would naturally suggest that the poison is volatile, and is evaporated by the bees before the cappings of wax are placed in position to seal the cells. So far as the honey produced by commercial beekeepers in the districts affected is concerned, there is no danger whatever, as the produce is not extracted from the combs until the cells are sealed, and private owners need not be afraid as long as they take the same precautions.

THE HORSE BOT-FLY.

A. F. COOK, Waipukurau :—

I shall be glad if you will advise me as follows : (1.) Will the larvæ of the bot-fly adhere to the stomach of a horse and eat away the mucous membrane, finally killing the horse? (2.) If so, can the larvæ be killed in the horse, and at what stage or month of the year? (3.) Is there any method of preventing the fly attacking the horse?

The Live-stock Division :—

Bots are the larval form of the bot-fly (*Oestrus equi*). The eggs are laid on the hairs of the front part of the body. They are licked off by the animal and taken into the stomach, where they develop into the bot. They are passed through the bowels during the early summer, when they complete their development into the adult fly. We do not think that by themselves the bots will actually cause death, but they may be a contributing cause with other complications. We have made *post-mortem* examinations on horses which have died from quite another cause, and found the stomach-lining covered with the larvæ. Many lines of treatment have been adopted for driving them out, but without success. Preventive

measures are simple, and are to be recommended. The eggs should be destroyed before being taken in by the horse. This is best done by singeing—either with a candle or wax taper—the hairs on which the eggs are placed. The parts where the fly strikes may also be smeared with a preparation the odour of which it dislikes. We have found the following preparation useful for the purpose: Creosote, 2 drams; oil of eucalyptus and turpentine, $\frac{1}{2}$ oz. each; salad-oil, 1 pint.

CRACKED HOOFS IN COW.

T. E. T., Tinwald :—

Could you inform me as to the best treatment for cracked hoofs in a cow. The cracks resemble the backbone of a fish, and run from the hair almost to the end of the hoof, one clove of both front hoofs being affected. Moisture exudes from the cracks when pressed.

The Live-stock Division :—

The treatment recommended is to soak the hoofs in an antiseptic solution—two tablespoonfuls of Jeyes Fluid or similar preparation to a gallon of warm water—until thoroughly cleansed. The cow should then be allowed to stand on clean, dry straw until the hoofs are perfectly dry. The cracks should then be filled up with Stockholm tar and the animal turned on to a dry pasture.

BLADDER OR POCKET PLUMS.

“SETTLER,” Matamata :—

Will you kindly tell me what is the cause of pods or bladders forming on Japanese-plum trees, and what treatment would be the best for same? The enclosed specimens were picked from a tree bearing several hundred similar pods but very few plums.

The Horticulture Division :—

The formation of “bladder” or “pocket” plums is caused by a disease known as *Exoascus pruni*. Though all the plums are liable to be affected, Japanese varieties are those most frequently attacked. The disease is most prevalent when the spring is abnormally wet. In cases, however, where the disease has previously appeared and not been checked, a tree may be badly affected even though the spring weather be not abnormally wet. Perfect control by spraying alone must not be expected, nevertheless it has been proved that spraying must accompany other measures. Spray with 8-6-40 bordeaux mixture just before growth begins in spring; with 4-4-40 when the cluster-buds open but before the blossoms open, and again when nearly all the petals have fallen. In cases where the earlier spraying has been neglected the only thing possible in this way is to spray with 4-4-40 bordeaux. At the same time thoroughly spray the surface soil also with the same mixture. All deformed plums should be gathered and burned or buried very deeply in the ground. Twigs that are badly affected should be cut off and burned. In aggravated cases it is sometimes best to head a tree down, and between the two extremes there may be intermediate treatment, such as the removal of branches, as may be thought necessary.

MANGOLDS AND PUMPKINS FOR PIGS.

W. G. S., Awapuni :—

Could you tell me if mangolds fed to breeding-sows would cause them to slip, as I have been told they do? Can pumpkins be given to pigs as feed?

The Live-stock Division :—

Brood-sows take no harm from mangold feeding, and are not likely to slip from this cause. Mangolds should not be fed, however, until after they have been stored for some time in a clamp or barn. Pumpkins are a valuable winter food for pigs, and should be grown in far greater quantities than is the case at present. Pumpkins are relished by pigs, and they help to bring the animals through the winter in good condition.

MAFFRA BEET-SUGAR FACTORY.

OPERATIONS AND RESULTS FOR 1919-20.

THE account of the operations of the Maffra factory published in the last two issues of the *Journal* brought the record up to the 1918-19 season. Particulars for 1919-20 are now kindly supplied by the Victorian Department of Agriculture as follows:—

1,080 acres were harvested for 13,084 tons of beet, producing 1,551 tons of white sugar. The price of beets was £1 15s. per ton. The yield was satisfactory (percentage of sugar in cossettes, 15.0; percentage of purity, 84.4), and, though expenses increased, a quick run and an advance in the price of sugar enabled the factory to show the substantial profit of £16,749 13s. 1d. The general expenditure was £50,416, and interest and depreciation £5,627.

The balance-sheet for the year is as follows: Liabilities at 30th June, 1920, £103,124 13s. 11d.; profit and loss account (profit for year after interest and depreciation, £16,749 13s. 1d., less balance of loss brought forward, £11,758 16s. 7d.), £4,990 16s. 6d.; total, £108,115 10s. 5d. Assets—Land, plant, equipment, &c., £50,851 18s. 4d.; debtors, &c., £7,801 12s. 1d.; stocks, £49,462: total, £108,115 10s. 5d.

These results, based on so small an acreage, states the Department, must be considered directly satisfactory; and indirectly, the employment of about 250 men, and the value of the by-products for dairying and stock-feeding, make the industry of particular value throughout the district. The demand for sugar is exceptionally keen.

IMPORTATION OF FERTILIZERS: SEPTEMBER QUARTER.

FOLLOWING are the importations of fertilizers into New Zealand for the quarter ended 30th September last, the name, quantity, and value of each kind, together with country of departure, being specified:—

Sulphate of Ammonia.—United Kingdom, 212 tons, £7,296; Australia, 160 tons, £6,049: total, 372 tons, £13,345.

Blood Manure.—Australia, 14 tons, £300.

Gypsum.—United Kingdom, 3 tons, £44.

Nitrate of Soda.—Australia, 111 tons, £2,780.

Basic Slag.—United Kingdom, 2,304 tons, £22,066; Belgium, 3,274 tons, £32,933; France, 75 tons, £687; Luxembourg, 510 tons, £4,264; Netherlands, 250 tons, £2,918: total, 6,413 tons, £62,868.

Blood-and-bone.—Australia, 57 tons, £940.

Bonedust.—Australia, 1,356 tons, £19,648.

Char Dust and Bone Char.—Australia, 459 tons, £3,299.

Guano.—United Kingdom, 35 tons, £745; New Caledonia, 4,026 tons, £6,180: total, 4,061 tons, £6,925.

Rock Phosphate.—Australia, 4,048 tons, £17,655; Makatea Island, 13,998 tons, £34,697: total, 18,046 tons, £52,352.

Superphosphate.—Australia, 6,452 tons, £49,937; Japan, 9,067 tons, £48,835: total, 15,519 tons, £98,772.

Other Phosphates.—United Kingdom, 1 ton, £14; France, 100 tons, £751: total, 101 tons, £765.

Kainit.—United Kingdom, 2 tons, £54.

Muriate of Potash.—France, 50 tons, £1,273.

Sulphate of Potash.—France, 74 tons, £2,048; Germany, 131 tons, £3,753; Netherlands, 16 tons, £438: total, 221 tons, £6,239.

Other Potash.—France, 100 tons, £712.

Sulphate of Iron.—Australia, 35 tons, £370.

Other Fertilizers.—United Kingdom, £10.

NOTE.—With regard to the "declared values" which are given above, the Comptroller of Customs makes the following explanation: "The value for duty is the fair market value in the country whence the goods are imported, plus 10 per cent. As the addition of 10 per cent. does not nearly cover the present freight, insurance, and other charges, the statistical value is a long way less than the actual landed value."

THE HORSE-BREEDING ACT OF VICTORIA.

THE Horse-breeding Act, 1919, of Victoria, and the regulations thereunder gazetted on 9th April and 21st July, 1920, respectively, which are now in force, bring into operation the compulsory registration of all stallions used for stud purposes within that State. The uncertificated horse is thus put right out of breeding operations, and may not even be used with the mares of his owner. A fine of up to £100 may be inflicted on any person using an unregistered stallion for stud purposes, the penalty applying equally to the owner of the mare served and to the owner of the stallion. "Owner," as defined by the Act, means any owner, whether jointly or in severalty, and whether absolutely or as lessee, or person in possession or charge of a stallion. Severe penalties are also provided to meet other contraventions of the Act. Thoroughbred stallions registered in the Australian Stud-book or in the register kept by the Victorian Trotting and Racing Association do not, however, come within the scope of the Act while being used solely in regard to thoroughbred mares also registered in either of these stud-books.

The Act provides for the keeping of a Register of Stallions by the Chief Veterinary Inspector of the Department of Agriculture, to whom application must be made and a fee of £1 forwarded on or before 1st July in each year in respect of each stallion requiring registration. The stallion must then be submitted for examination by a veterinary officer of the Department of Agriculture at the most convenient inspection parade of the series held in the various centres for this purpose. Failing this, the owner must make application for a special parade, for which an extra fee is chargeable. If, as a result of this examination, the animal is found to be of reasonable standard as regards type, conformation, and breeding, and is free from the following forms of hereditary unsoundness—namely, hog-spavin, bone-spavin, cataract, chorea ("shivering" or "nervy"), curb, navicular disease, nasal disease (osteoporosis), ringbone, roaring, sidebone, stringhalt, thoroughpin, whistling—its name will be entered on the register and a certificate issued. In the case of registration being refused the owner may apply for re-examination of his stallion by an appeal board consisting of the Chief Veterinary Inspector and two members of a panel of referees constituted for that purpose.

Should circumstances warrant, a special examination of any registered stallion may be made at any time, and as a result of such examination registration may be cancelled. Any stallion of which registration has been refused or cancelled may not be again presented for examination except to the appeal board, whose decision will be final. Exemptions from annual examination are made in the case of stallions of five or more years of age which have been registered under the Act, or in respect of which a "life" certificate of soundness has been issued by the Department of Agriculture before the commencement of the Act.

Each certificate of registration issued under the Act remains in force for one year, and must be returned to the Chief Veterinary Inspector when making application for reregistration at the end of that time. Notice must also be given and the certificate returned in the event of the sale or letting of the stallion, or of its castration or death. In the former case the register entry will be altered and the certificate endorsed to the new owner. Steps must be taken to have this effected immediately the sale takes place, as the seller's certificate, unless endorsed, holds good only for one month thereafter. The certificate or a certified copy (which may be obtained on paying an additional fee of £1) must be produced on the demand of either the owner of a mare to be served, an officer of the Department of Agriculture, or a police officer.

ESTIMATED AREAS UNDER WHEAT AND OATS.

THE Government Statistician has issued estimates of the areas under wheat and oats in the Dominion for the current season, based on the usual card census, as follows: Wheat—South Island, 208,300 acres; North Island, 5,600 acres: total, 213,900 acres. Oats—South Island, 408,200 acres; North Island, 60,500 acres: total, 468,700 acres. In the previous (1919-20) season the corresponding totals were approximately 142,000 acres of wheat and 576,000 acres of oats. As regards wheat varieties sown this current season, growers have furnished the following acreages: Tuscan or long-berry, 116,009; Hunters (various), 57,425; Velvet or Pearl, 19,230. The balance of the total area is unspecified.

REGULATIONS FOR THE INTRODUCTION OF BEES, HONEY, AND APPLIANCES INTO NEW ZEALAND.

THE conditions under which bees, honey, and appliances (the latter comprising any hive, frame, comb-foundation, or other thing used in connection with the keeping of bees and the harvesting of their products) may be introduced into New Zealand are defined in regulations under the Apiaries Amendment Act, 1913, which were gazetted on 7th October last and came into force on that date.

The introduction of bees and honey is absolutely prohibited except as specified. Auckland, Wellington, Lyttelton, Dunedin, and Bluff are appointed the only ports of entry for bees and honey; consignments for other New Zealand ports must therefore obtain a permit to land from the Inspector of the Department of Agriculture at one of these ports before being finally landed at their destination. Bees may also be introduced through the parcel-post, in which case they will be held for examination at the chief post-office for the district in which their port of entry is situated.

Bees may be imported from any province or State of Italy, the United States of America, or of the Commonwealth of Australia, but must in each case be accompanied by a certificate signed by the shipper setting forth all particulars as to the origin and packing of the consignment, and certifying that the bees and containers are clean and free from disease, and that foul-brood is not known to exist within five miles of the apiary from which they were obtained. This declaration must be certified as correct by a responsible officer of the Department of Agriculture of the country or State in which the bees were bred.

Honey may be introduced into New Zealand from any State of the United States of America or the Commonwealth of Australia, provided that each consignment is accompanied by the shipper's declaration as to its freedom from disease, the State in which it was produced, &c., such certificate to be officially certified as in the case of bees.

In the case of both bees and honey the official certificate must certify that the disease *Nosema apis* (known as Isle of Wight disease) is not known to exist in the country or State in question.

With the exception of containers necessary for the introduction of bees into New Zealand, no appliances which have been used in connection with bees may be imported.

On the arrival of bees or honey at a port of entry they will be examined by the Inspector, who, if satisfied that they are free from disease, that the accompanying certificates are in order, and that the law has been fully complied with, will issue a permit for their landing. Power is given the Inspector to seize any bees, honey, or appliances introduced or attempted to be introduced without compliance with these regulations, and to either destroy the same or to reship them to some port outside New Zealand at his discretion. Any expense incurred in this connection must be borne by the owner of the bees or honey.

Any person committing a breach of the regulations is liable to a penalty of £5.

RURAL EDUCATION.

At a meeting of the Board of Agriculture, early this month, Dr. Reakes, Director-General of Agriculture, reported that the recommendations with regard to rural education which the Board had made to the Council of Agriculture had been subsequently brought forward and discussed at a conference held recently in Wellington between the Agriculture and Education Departments, and that this gathering had endorsed most of the suggestions that had been made by the Board.

Steps had been taken to define the sphere of action of the officers of both Departments. It had been decided that the Instructors of the Education Boards should deal with rural education in the primary, secondary, and technical schools, while the officers of the Department of Agriculture should undertake the practical farm training of the farmers and of the lads who had left school. Pending the securing of a sufficient number of instructors to meet requirements the field officers and instructors of the two Departments would work in co-operation. Steps were also taken to provide for the training of more instructors in the various branches of agriculture, both for the Department of Agriculture and for the Educa-

tion Department. It was urged that facilities for teaching the subjects required for the B.A. pass in agricultural science and for advanced agricultural science for the B.Sc. degree should be provided at each of the University colleges; and, further, that increased encouragement should be given at the training colleges to students who show a special aptitude for agricultural work to proceed to an agricultural college to complete their training. It had also been agreed between the two Departments that a bureau of information and guidance should be established to induce lads from secondary and technical schools, as well as teachers and other persons, to pursue a course of study in agriculture and to advise them concerning the steps they should take.

Agricultural Clubs for Boys and Girls.—The conference of the two Departments had also endorsed the recommendation of the Board of Agriculture that steps should be taken to initiate agricultural clubs for boys and girls in various parts of New Zealand, on similar lines to those which had been found of such great service in Canada and the United States of America in awakening an interest in improved methods of raising crops and live-stock. Dr. Reakes stated that he would be glad to have the views of the Board as to the best methods to bring the agricultural and pastoral associations and other farmers' organizations into this movement. After some discussion, the Board recommended that an organizer should be appointed to visit the different districts and the agricultural and pastoral associations, &c., that wished to start clubs of this description in their centres; also that a sum of money should be set aside for the purpose; further, that the agricultural and pastoral associations be invited to co-operate in the movement by opening special classes, and offering prizes for the best animals or produce exhibited by members of such clubs.

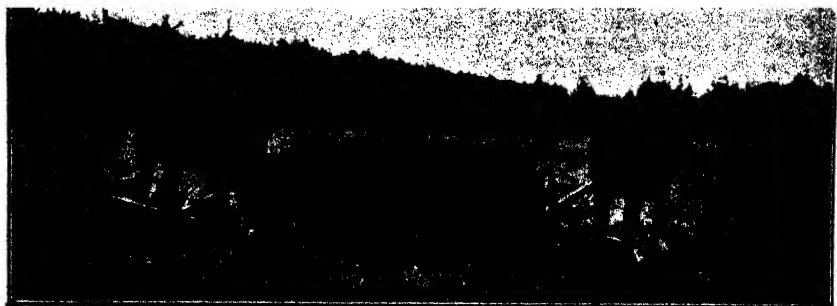
THE SEASON'S LAMBING: NORTH ISLAND ESTIMATE.

THE estimated average lambing in the North Island for the current season (computed from estimates furnished by the Inspectors of Stock in the various districts) is 87.95 per cent. On the basis of 5,838,704 breeding-ewes in the North Island, as shown in the last sheep returns, the estimated number of lambs works out at 5,135,524. The estimated percentage in 1919 was 81.57, and the number of breeding-ewes 6,311,797. South Island and Dominion estimates for the current season will be published in next month's issue.

Introduction of Live-stock into Fiji.—The Fiji Government regulations governing this matter, which were gazetted here for general information on 8th April last, have been amended in various respects. The amendments are published in the *New Zealand Gazette* of 16th September, 1920.

Packing of Cheese.—The following regulations under the Dairy Industry Act were gazetted on 21st October and came into force on the same date: (1.) Every owner of a registered dairy manufacturing cheese shall keep his cheese on shelves for at least fourteen days before packing them. (2.) He shall also, before sending any cheese to an appointed grading-store, plainly mark on every package of such cheese the vat-number and the day and month of the manufacture of such cheese.

Alsatian Potash Fertilizers.—The following is from the *Chemical Age*, of July last: "The demand for Alsatian potash salts continues good. The following quantities have been shipped to the United Kingdom during the past week: 14-per-cent. sylvinite (French kainit), 4,041 tons; 20-per-cent. sylvinite (French manure salts), 2,648 tons; 50-per-cent. muriate of potash, 240 tons. The following prices are quoted: Sylvinite, 14-16 per cent., £7 15s. per ton, f.o.r.; sylvinite, 20 per cent., £9 15s. per ton, f.o.r.; sylvinite, 30 per cent., £14 per ton, f.o.r.; muriate of potash, 50 per cent., £28 7s. 6d. per ton, f.o.r."



The New Zealand Journal of Agriculture.

VOL. XXI.—No. 6.

WELLINGTON, 20TH DECEMBER, 1920.

NAURU AND OCEAN ISLANDS.

STORY OF THE PHOSPHATE DISCOVERIES AND WORKINGS.

ALBERT F. ELLIS, New Zealand Commissioner.

DURING the last year Nauru Island, by reason of its valuable phosphate deposits, has been brought prominently before the public eye. Previous to the war it was German territory, and therefore its future had to be decided at the Peace Conference, with the result that a mandate over the island was given to the British Empire. As regards the individual country which was to administer the mandate, there was some difficulty. Australia laid claim to the island by right of conquest and its proximity to Australia, but as it had been occupied on behalf of the Imperial Government this claim could not be held to nullify other claims. New Zealand entered a claim also, on the ground of proximity and the urgent need for guaranteed supplies of phosphate for future years. After somewhat prolonged negotiations, conducted very ably as regards New Zealand by our Prime Minister, a settlement was arrived at by which it was agreed that Great Britain, Australia, and New Zealand should work the phosphate deposits conjointly, and derive supplies on the basis of their approximate requirements. The first two countries were

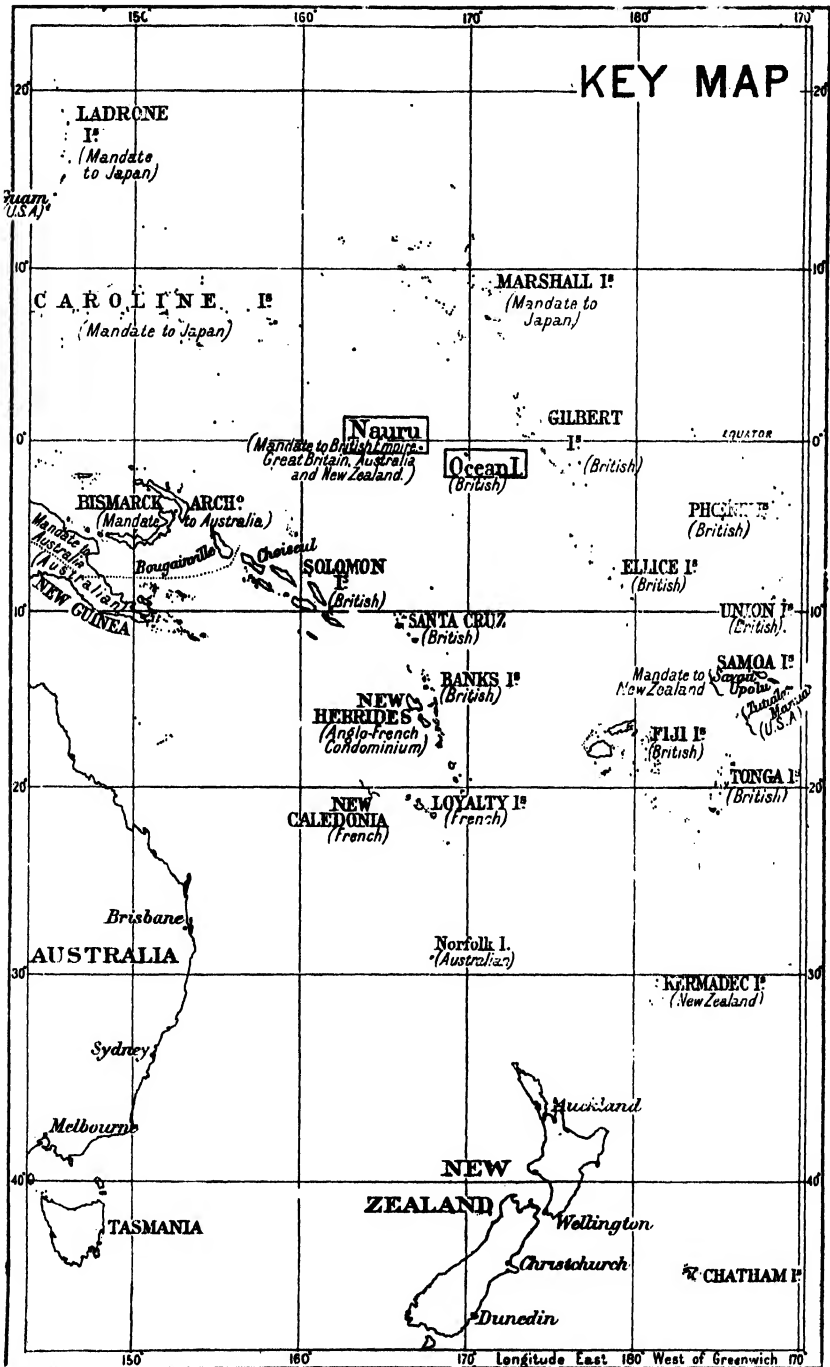
each to receive 42 per cent. of the annual output, New Zealand receiving 16 per cent. It was further agreed that these proportions were subject to revision at the end of each period of five years, and that the Pacific Phosphate Company's business at the island should be bought at a fair valuation. Such, in brief, are the main lines of the settlement.

With regard to the past history of Nauru Island, the phosphate deposit, manner of working it, prospects for the future, &c., a great deal of misapprehension exists. The place is well out of the beaten track, and the only systematic account of late years is from the pen of the Australian journalist, Mr. T. J. McMahon, who visited both Nauru and Ocean Islands, and wrote interesting descriptions of them from the standpoint of a visitor. It is proposed in these notes, written during the leisure of a long sea voyage, to describe the islands, the conditions of working, and other phases of the industry, primarily in order that the New Zealand farmer, who is so vitally interested in the subject of fertilizers, may have first-hand information regarding the industry. In describing the formation of the two islands and their deposits technical terms will be avoided, and any readers who desire to know more of the scientific aspect of the deposits are referred to a pamphlet written by Mr. F. Danvers Power, entitled "Phosphate Deposits of Ocean and Pleasant Islands." The moral of the story is embodied in the hope that the New Zealand farmer will be led to avail himself more and more fully of the wonderful Nauru and Ocean Islands phosphate, whether in the form of superphosphate or the raw finely ground phosphate. There can be no doubt that money so spent yields a good return to the farmer and benefits the Dominion generally in the form of increased production. Nauru will be dealt with first; Ocean Island resembles it in many ways, but has a different history and other features.

NAURU OR PLEASANT ISLAND.

Originally the name "Pleasant Island" was generally used, and it is still frequently seen in maps and charts, but when the island became German territory, in the year 1888, the Germans adopted the Native name entirely. Apparently it will be commonly used in the future, though many of us older hands would prefer reverting to the original appropriate name.

The island was first discovered by Captain Fearn, of the "Hunter," in 1798, and he was said to have been so impressed by the "pleasant" features and manners of the inhabitants that he named it accordingly. They are brown-skinned, straight-haired people, apparently of Polynesian origin, and of fine physique, though, like most Pacific-islanders, lacking in stamina. At the present time they number probably twelve hundred. We have comparatively little record of their early history. Mr. F. J. Moss's book, "Through Atolls and Islands of the Great South Seas," contains a very interesting account of his visit to the island before it was occupied by the Germans. The Natives were then doing a good deal of fighting amongst themselves, principally in the form of "sniping." No doubt they were put up to it by some of the "beach-combers" or "pakeha-Maoris" living there, in order to stimulate a demand for firearms and ammunition. Mr. Moss expostulated with some of the Natives over the senseless waste of life, but was always informed that it was "the other fellow's" fault—a not uncommon plea among their



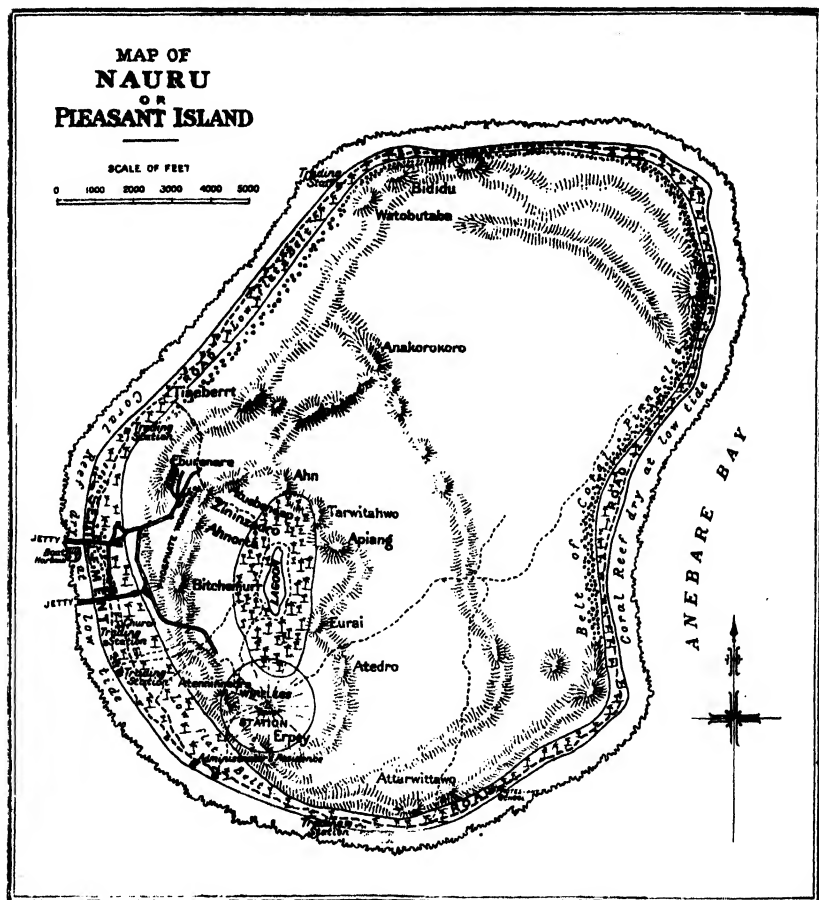
white brothers under similar circumstances. The "beach-combers" were of a low type, mostly runaway sailors or escaped convicts; it was at their instigation that in the early days a sailing-vessel was cut off by the Natives and plundered. When the Germans occupied the island the Natives were all disarmed, and intertribal fights have long since been a thing of the past.

Up to the year 1900 Nauru was looked upon only as a rather important copra-producing island, sometimes yielding over 400 tons in a suitable season. In 1876 the phosphate deposits might easily have been discovered, and definitely lost so far as the British Empire is concerned. An American company had been working guano islands in the Phoenix Group, several hundred miles to the eastward, and, as the deposits became exhausted there, they sent out a prospecting expedition in the schooner "Ariel" to examine other islands in that latitude. It is not known if the prospectors actually went ashore at Nauru and Ocean Islands, but probably, as they were known to be of different formation to the low-lying islands of the Phoenix Group, they passed them by and went on to the Marshall Group, which are also low-lying islands.

Early in 1900 the phosphate deposits were discovered, and as this took place in a rather unusual way the writer is tempted to relate the incident, particularly as, together with subsequent developments, it explains the fact that when war broke out in 1914 a British company, with headquarters in London, was working the Nauru phosphate deposits under a ninety-nine years' concession from the German Government. People had been so accustomed to hearing of German penetration of British interests that it appeared inconceivable that a British company could legitimately penetrate German interests. Nevertheless that is what actually took place.

Hitherto no first-hand account of the discovery has appeared in print, and such accounts as have been written contain various inaccuracies. Just prior to 1900 the writer had been serving as manager on one of the islands of the Pacific Islands Company on the Queensland coast, and had been transferred to the company's Sydney office, where an analytical laboratory had been installed for the purpose of dealing with samples of cargoes, &c. His attention was arrested by a large block of rock used for keeping open the door of the laboratory; in some ways it resembled a rare kind of phosphate rock, of which a small deposit had been found in a deep depression on Baker Island, in the Phoenix Group, several years previously. On mentioning the matter to the company's manager he was told that it was a lump of petrified wood found by himself on Pleasant Island some three years previously, and that one or more geologists had agreed as to its nature. This seemed decisive enough, but somehow, when working in the laboratory, that piece of rock repeatedly attracted the writer's attention, and some three months afterwards the thought occurred, "Why not test it?" A chip was knocked off, ground up, and tested for phosphate, with such a decided reaction that a complete analysis was made, and the humble door-chock proved to be phosphate rock of the highest quality. Moreover, from its formation, there were evidences that it came from an old and probably extensive deposit; as to the latter the manager was very emphatic.

The question then arose as to how control of the deposit could be obtained, and this matter was promptly taken in hand by the company's head office in London. The position was that a large German chartered company held mineral and other rights over the German Caroline and Marshall Islands north of the Equator, and also over Nauru. On the other hand, the Pacific Islands Company, who were the immediate predecessors of the Pacific Phosphate Company, held numerous coconut properties and trading-stations on the German islands which the



chartered company referred to was particularly desirous of acquiring. Negotiations ensued, with the ultimate result that the Germans acquired the trading-stations on their own islands, and the Pacific Islands Company obtained the concession to work Nauru. The Germans also received a certain number of shares in the company and a royalty per ton on the phosphate exported, so that it was a transaction which proved profitable to them, though not to the extent that it did to the Phosphate Company and to British interests generally.

Meanwhile the writer had been sent up to Ocean and Nauru Islands to ascertain the extent and quality of the deposits. The former island was included, as it was known to be of similar formation to Nauru—namely, an “elevated coral island.” It was visited first, and, after a three-weeks stay there with the Natives, arrangements were made for starting operations, as will be described subsequently. Nauru was then visited with a view to “seeing everything and saying nothing,” as the negotiations had not then been completed. A visit was first paid to the German Magistrate, and permission asked, through an interpreter, who had resided there for many years, to prospect the island. They were both very emphatic that there was nothing to find, saying that German warships, sometimes with scientists aboard, had visited the island annually. The desired permission was given, however, and Native guides were supplied. Proceeding inland after crossing the coconut belt on the coast, rising ground was reached, and this was seen to be phosphate country. The track was followed inland for miles, prospecting operations consisting of knocking off a piece of rock occasionally and testing it with acid, or else of scraping a hole in the ground for the same purpose. These frequent operations were watched by the Natives with blank amazement, and subsequently with smiles of pity. On returning to the settlement they informed one of the resident Europeans that the white man from the steamer was quite mad; he kept examining the rocks, pouring medicine on them and carrying away pieces in bags—a procedure so extraordinary to their minds that there could be only one explanation of it. The Nauru Natives are strong on nicknames. Accordingly the man who first poured medicine on the stones was dubbed “the stone man,” and remains so to this day.

The operations of the Pacific Phosphate Company were concentrated on Ocean Island for several years, and, when the demand for its high-grade article had increased to such an extent as to exceed its capabilities, arrangements were made for working Nauru. Being German territory, it was considered expedient to appoint a manager of that nationality, but he was without experience of the unique conditions of phosphate islands, and his appointment did not prove successful. The harbour and mooring master from Ocean Island, Captain P. Theet, one of the company's oldest and most valued servants, was then placed in command, and under his experienced and energetic control Nauru was soon placed on a paying basis. He relinquished the management just before the war, having decided to “cast anchor” close to Auckland.

When war broke out in 1914 about two-thirds of the company's staff were British and the remainder were German, as also, of course, were the Government officials, supported by a considerable force of armed black police. As might be expected, complications arose before long, with the result that the German Governor ordered the Britishers, with their wives and families, off the island in a neutral vessel then lying there, which took them across to Ocean Island. Meanwhile, however, the company had been in touch with the Imperial and Australian authorities, stressing the importance of having the British flag hoisted on Nauru, and about a week after the expulsion of the British staff H.M.A.S. “Melbourne” suddenly put in an appearance there. The German Governor took a sensible view of the position

and agreed to surrender the island when called on to do so, but as there were many Chinese labourers on the island at the time the formal hoisting of the flag was postponed. Some weeks afterwards a small force of Australian soldiers was sent up in the company's chartered s.s. "Messina" to occupy the island. She proceeded first to Ocean Island, took aboard the expelled Britishers, and went across and landed them at Nauru, when the flag was hoisted with all due ceremony. The Germans were deported to Sydney, where most of them were interned. Only a few days afterwards a Japanese warship and a transport with troops arrived off Nauru for the purpose of occupying it, as had just been done with the Caroline and Marshall Groups.

Such, in brief, are the incidents in connection with the war. It goes without saying that the company's staff on both islands did their



A TYPICAL PHOSPHATE-FIELD AT NAURU ISLAND.

Most of the phosphate has been removed, thus denuding the coral pinnacles.

part as regards war work. Many left on active service, including some of the senior staff, whose services could ill be spared. Several gained decorations, and it is a gratifying fact that nearly all who survived have returned to the employ. At Ocean Island an efficient defence force was organized, as a precaution against raiders, and the members had volunteered to go across and take Nauru, but this was not encouraged by the authorities.

Promptly after the outbreak of war the London board of directors complied with the requirements of the law and gave particulars to the authorities regarding the enemy holding of shares in the company. These had been increased considerably a few years previously, owing to the fact that German capitalists promptly realized the value of the industry and bought a good many shares in the open market. In due

course these shares were advertised for sale by the Public Trustee and sold by public auction in London, being bought by a large shipping company for a considerable sum. This transaction finally cleared off all enemy interests in the phosphate company. When the British flag was hoisted phosphate operations were promptly resumed, and have since continued without a break. Under the new arrangement with the three Governments the transfer of the business has taken place as at the 1st July of this year, and so it may be considered that the Pacific Phosphate Company is off the scene. The business has been taken over as a going concern, and the authorities concerned have indicated their desire that the company's employees should continue under the new regime as being an important factor towards the continued success of the operations.

The passing of an old-established business house cannot but be regretted by many. The Pacific Phosphate Company, with its predecessors the Pacific Islands Company and Messrs. John T. Arundel and Co., has carried on operations in various parts of the Pacific for nearly fifty years, and those who know most about the business will agree that the honourable conduct of its operations has been equalled only by the enterprise shown in the face of many unique difficulties. Up to the year 1900 the company's operations were on a comparatively small scale; only small deposits of phosphate—or "guano," as it was then called—were available, and each island was worked out in two or three years, necessitating shifting to another. This meant that there was very little money in the business; but in 1900 the company figuratively "struck oil."

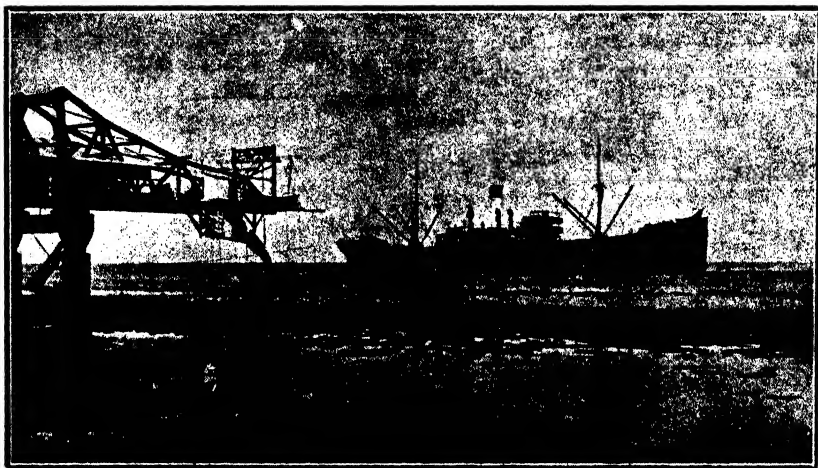
It need hardly be said that the taking-over of the business by the three countries referred to was not done by the wish of the company. However, there are many things to take into consideration, and there is little doubt that future years will justify this altogether unprecedented arrangement. It is singular that the British Empire, so rich in natural resources generally, is not rich in known phosphate deposits. There is a moderate-sized deposit of high grade at Christmas Island, in the Indian Ocean, and deposits of medium quality in Egypt. With the exception of these, other known deposits within the Empire are unimportant. We do not know what the future may bring forth, and there can be little doubt as to the wisdom of conserving the wonderful deposits of Nauru and Ocean Islands for the benefit of the Empire. For some time past the United States has taken steps to conserve a large proportion of its deposits.

Some adverse comment has been made regarding the sum paid to the company as compensation—three and a half millions sterling. Apart, however, from the question of the enormous deposits and the profits which would have been made by the company in working them, it must be borne in mind that there is an elaborate plant at each island. The erection of this alone, under present conditions, would absorb the best part of the sum referred to.

On referring to the accompanying key map the locality of Nauru and Ocean Islands will be seen. They are 160 miles apart, and are situated nearly due north from New Zealand, within one degree of the Equator. Nauru is approximately eleven miles in circumference, three miles and three-quarters long, and two miles and three-quarters wide, the area being nearly 5,000 acres. A flat fringing reef, from 100 to

200 yards in width, surrounds the island, and this is dry at low tide. Above the reef is the white sandy coral beach, and then a flat sandy belt running round the island, varying in width from about 30 yards on the eastern side to over 400 yards on the western, where the settlement is situated. This belt is an unbroken coconut grove, with the Natives' huts interspersed through it. A good road has been made right round the coast, mostly in the shade of the coconuts, and it is a pleasurable experience to run round in the car used for collecting the copra. In many ways Nauru is a beautiful island, and were it closer to New Zealand would attract an embarrassing number of visitors by reason of its picturesque scenery, interesting Native inhabitants, and unique industry.

Beyond the flat coconut belt comes the phosphate country, mostly at an elevation of about 100 ft., with hills here and there, the highest being about 210 ft. above sea-level.



STEAMER LOADING PHOSPHATE AT NAURU ISLAND.

Lighter ready to take its load at end of steel cantilever jetty. Low tide on the reef.

A noticeable feature is the lagoon, with its surrounding dense coconut grove, and what is known as the "bush village." This lagoon is slightly brackish, so evidently it has subterranean connection with the sea. It is carefully divided up into sections by means of barriers of coconut-leaves placed on top of each other, thus forming a low fence. Each section is owned by a family or group of families, and has been handed down by their ancestors. They guard their rights to these sections even more zealously than they do their coconut lands. The lagoon is, in fact, a valuable preserve for cultivating fish. On the ocean reef the spawn of a certain kind of fish is caught and carried across to the lagoon in coconut-shells. In a comparatively short time the spawn develops into fine fish 1 ft. to 2 ft. in length. If allowed to remain longer they have been known to grow to 4 ft. Nothing is done in the way of feeding them, and they thrive so well on what they find that

it is possible to fry them in their own fat. When the bush-village Native goes for his morning bath, by taking a small scoop-net with him he can bring ashore fish for breakfast.

With the exception of the lagoon and surrounding coconut grove the interior is practically waste land, with clumps of bush trees and scrub here and there. The Native way of growing water-melons there is interesting. Well away from the villages, where the pigs are always foraging, a man will set fire to a fallen tree, and afterwards drop a few seeds in the ashes. No further attention is required, and in due course a crop of really good water-melons is obtained. The potash in the wood-ashes, combined with a sufficiency of phosphate, is, of course, the secret.

There is no soil on Nauru in the ordinary sense of the word; it is all phosphate, except, of course, on the coastal belt. The vegetation grows right out of the phosphate, and, provided there is adequate rainfall, it thrives. One would think that such high-grade material would be too rich for plant-life, but it is in the insoluble tribasic-phosphate-of-lime form. The roots, either by means of their acid secretions or through the organic acids in the soils rendering a portion of the phosphate soluble, take up enough for their requirements, and the excess which is present does not have any prejudicial effect on their growth.

Though the phosphate deposits extend over the whole of the interior it does not follow that there is nothing else but phosphate. The bed-rock of the island is coral limestone, of a hard compact nature and strange pinnacle form. The pinnacles vary in height from a few feet to 30 ft. or even more. They are supposed to have been formed by the action of the sea in first forming caves, the roofs of which wore thinner and thinner until they fell in, leaving the walls standing. These in places wore through, and the pillars gradually assumed the pinnacle form.

The phosphate is found in between the pinnacles and often covering them entirely. When a new "workings" is started there may not be the top of a single pinnacle in sight, but as the phosphate is removed plenty of them soon appear. The question naturally arises, How did the phosphate come there? What may be called the "bird theory" is usually looked on as the most probable one. If correct, the locality must have been the habitat of myriads of sea-birds—to a much greater extent that it is now. In that case the soluble phosphates from their excreta would combine with the lime in the underlying coral rock, becoming fixed as tribasic phosphate of lime. We can tell by observing the terraces on the island and by examining the formation of the phosphate rock that the island has been depressed below the sea and elevated several times. For instance, water-worn phosphate pebbles consisting of smaller water-worn fragments may be found, and this conglomerate rock affords proof of subsidence. The alternate submerging and elevating processes which Nauru and Ocean Islands have been subject to in bygone ages have been the means of washing out all the carbonate-of-lime impurities, thus producing a deposit which for richness is almost phenomenal. The islands have, in fact, been a vast laboratory in which nature by her wonderful methods has made provision for the needs of humanity.

The bird theory is open to objections. Though all sorts of fossil marine organisms are found in the phosphate—corals, shells, sea-urchins, and sharks' teeth and bones—we never by any chance find remains of birds' bones or eggs. Patches of phosphate rock have also been found, under puzzling conditions, when excavating on the ocean reef. However, for want of a better, we accept the bird theory.

The phosphate exists mostly in a form and colour similar to our New Zealand gravel, but here and there we find enormous boulders of phosphate rock, sometimes weighing several tons, and these have to be blasted up with explosives. This rock is of varying degrees of hardness, there being quite an extensive variety of formations. Sometimes the boulders have previously been a particular kind of coral, called by sailors "niggers' heads" or "horses' heads." Through being buried in the phosphate for so long chemical action has set in;



STREET AT THE PHOSPHATE SETTLEMENT, NAURU, SHOWING THE UNMARRIED-STAFF HOUSES.

soluble phosphates have liberated the carbon dioxide from the coral and have combined with the lime, forming a phosphate rock quite as rich as the rest of the deposit, while the original structure of the coral is retained. A change takes place in the colour of the material. The coral rock ordinarily is white; when "phosphatized" it becomes brown or sometimes grey. There is no smell or unpleasantness about the phosphate other than its dustiness, which cannot be considered a fault, and which has no harmful result.

Cargoes of Nauru phosphate run from 85 to 86 per cent. tribasic phosphate of lime. Occasionally patches running as high as 87 per cent. to 88 per cent. may be met, but in working it is found advisable to mix all together. There is no low grade, and it would be impossible to ship a cargo running below 80 per cent. unless impurities were deliberately mixed in. Some of the phosphatic fertilizer brought into

New Zealand from other sources depends for its value on about 30 per cent. of tribasic phosphate; other well-known brands contain 62 per cent. It will therefore be seen that the Nauru article is excellent, and it is expected that New Zealand farmers will give decided preference to it, whether in the form of superphosphate or finely ground raw phosphate.

When we consider the great expense incurred by the farmer in freighting his fertilizer, whether by sea, rail, or road, it must be evident that in handling a high-grade article a very great saving is effected, a ton of Nauru phosphate containing more phosphate of lime than 2 tons of a certain other brand. It may be contended that sometimes when a high-grade fertilizer and a low-grade are tried against each other the latter gives equal results. This, however, may be misleading, as there are other factors in the soil which may have a bearing on the subject; but there can be no doubt that what the soil wants is phosphate, and the high-grade article, bulk for bulk, supplies the greater quantity. It may also be contended that the carbonate of lime in low-grade fertilizers is a valuable constituent. There is, however, plenty of carbonate of lime in New Zealand without bringing it from overseas, and the farmer can buy it locally, with the advantage of getting it freight free by railway up to 100 miles.

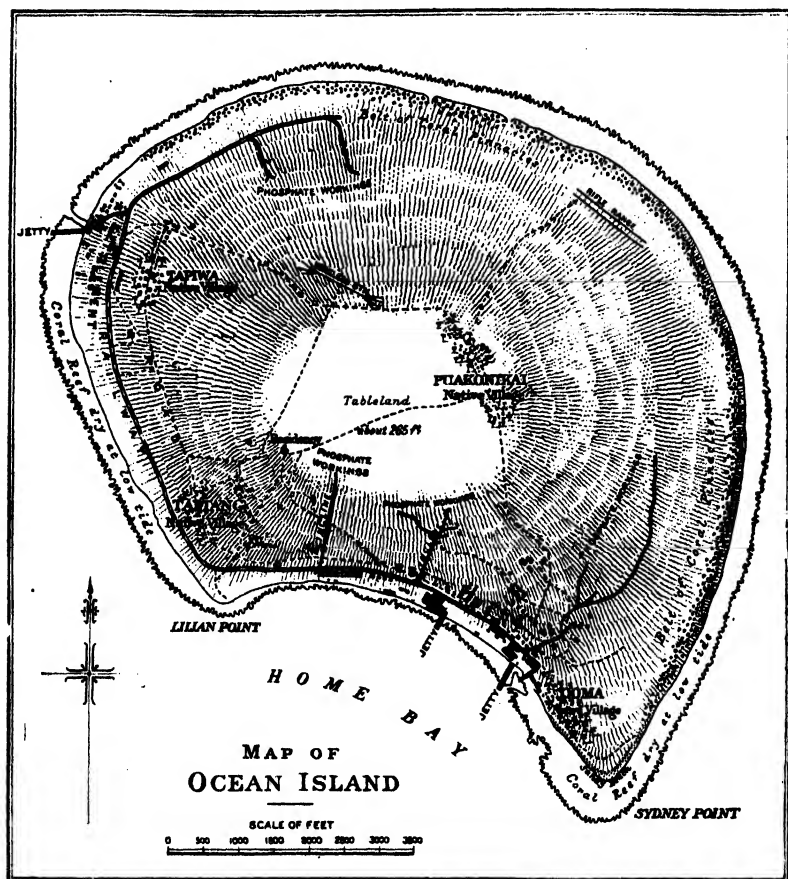
With regard to the total quantity of phosphate available on Nauru, owing to the uneven nature of the deposit occasioned by the pinnacle formation it is impossible definitely to calculate the tonnage. The original estimate was in the neighbourhood of 50,000,000 tons, but there is good reason to think that there is at least half as much again.

We will now proceed to follow the phosphate from the "field" to the ship. It might be supposed that, as the quantity is so large and there is deep water close in, all that remains to be done is to put the vessel alongside a bank and run loaded trucks right aboard at a mere nominal expense. That, unfortunately, cannot be done, and, as a matter of fact, the operations are comparatively expensive. The first thing is to strip off the vegetation, and occasionally remove a light coating of leaves and rubbish from the surface of the deposit, which is then ready for quarrying. Tram-lines are led up to it at a low level, the trucks used being of one-ton side-delivery type. As far as possible the deposit is excavated on the face, the material being shovelled directly into the trucks; or if a considerable gang of men is at work they load several trucks at a time, using either light "canal" barrows, which are dumped from wheeling-stages; or, in the case of the Chinese coolies, each man has two baskets and a pole, carried on the shoulder. The upper portion of the deposit is easily removed, but clearing out the lower levels from between the bases of the pinnacles is much slower and more difficult. A more up-to-date quarrying plant has been installed at each island in the form of a modern cableway. From two high steel towers about 200 yards apart a wire rope is suspended, and along this a traveller runs backwards and forwards; empty skips are lowered down between the pinnacles, filled with phosphate, hove up and run along to a hopper on the tram-line by means of a fast electric winch. This system has certain advantages, but so far has not supplanted the older method of barrows and baskets.

A rake of trucks having loaded up, a small locomotive then runs them along to the drier-shed, where the phosphate is dumped into the

"wet" bin. From this the material drops into rotary rock-breakers, which reduce any rock to the size of small nuts. It then passes into the artificial driers. These are large revolving cylinders about 60 ft. long with a furnace at one end. As the material passes through it is dried, and is then removed to the storage-bin by means of elevators and conveyers, being now ready for shipment.

We now come to the shipping operation, which is far and away the most difficult problem, but which has been fairly well solved. Nauru



and Ocean Islands are really mountains with their tops above the sea. The sides go down at an angle of 45 degrees, and this means that vessels cannot lie to their own anchors, simply because when they swung inshore they would inevitably come in on the reef. The difficulty has been overcome by putting down moorings, probably the deepest in the world. The outer anchor is dropped in about 180 fathoms, or 1,080 ft., and the mooring-buoy which supports the "up-and-down" portion to which the vessel moors is probably the largest size made. The laying of these moorings is a difficult and expensive matter, but a system of

doing it has been perfected by an Auckland, Mr. G. W. W. Cozens, an old servant of the company, who has been in charge of this department for many years. The vessel lies to the mooring-buoy about three ships' lengths from the jetty, and all that is needed to give her quick despatch is ordinary fine weather.

At Nauru small electric locomotives are used for running the loaded trucks from the storage-bin to the end of the jetties, where the phosphate is dumped into a hopper. The lighters used are surf-boats carrying from $2\frac{1}{2}$ to 3 tons of phosphate, which is contained in four large baskets in the middle of the boat. The Native boatmen are most expert at their work; a boat will swing in under the shoot, the door of the hopper is opened, and in less than a minute the boat is away with its load. Oil-launches tow the lighters off to the steamer, where the baskets are hoisted up, emptied, and returned to the lighter. In fine weather 1,000 tons can be shipped in nine hours, and frequently another shipping gang carries on after dark, when a wide-angle searchlight is used for lighting up the end of the jetty and out to the steamer. The vessels used in the trade mostly have a carrying-capacity of from 5,000 to 6,000 tons of phosphate. It is necessary to avoid having boats of a much larger size, as an undue strain would be placed on the moorings.

It will be seen from the foregoing that the phosphate is shipped in bulk in its raw unground state. Various suggestions have been made in New Zealand recently to the effect that works should be established on the island for treating the material and shipping it in the form of either superphosphate or else finely ground raw phosphate. The argument commonly used in favour of the proposal is that labour is cheaper on the island than it is in New Zealand. While this is true, there are good reasons why the present system should be continued. As regards superphosphate-works, a small island in the middle of the ocean, without a harbour and where many difficulties are encountered which naturally do not pertain to the mainland, is about the last place to select for the erection and running of what would necessarily need to be elaborate and extensive works. At the present time a good deal of material has to be landed at the island, and it is found by experience that practically as much labour is involved in landing 1 ton as in shipping about 10 tons of phosphate. Superphosphate-works would entail the landing of large quantities of sulphur and other material, besides employing many more men under conditions which are necessarily more expensive than on the mainland. The same objections apply to some extent to the proposal to grind finely the phosphate on the island so that it may be ready for use on arrival at New Zealand. A further drawback to the proposal is that phosphate in that condition would have to be shipped in bags, otherwise most of it would blow away during the operation of shipping. Experience has shown that it is very much slower to ship phosphate in bags than in bulk, owing to the peculiar conditions prevailing on the island, and therefore it is inadvisable to change the phosphate from a condition in which it is easy to handle to the reverse condition.

The principal factor in delivering cheap phosphate must of necessity be the steamer freight, and in order to secure the lowest possible rates all arrangements must be made at the island with the view of giving the quickest possible despatch to the vessels. Quick shipping is there-

fore the crux of the situation, and nothing must be allowed to come in its way. While a shortage of fertilizer-works in New Zealand has been in the past, and still is, a serious drawback, it is gradually being overcome, and it is hoped that in the near future works at the various centres will be capable of dealing with all the raw phosphate brought



QUARRYING PHOSPHATE IN FIRST-CLASS COUNTRY, OCEAN ISLAND.

into the Dominion. Fertilizer-works should therefore be situated at sea-ports close to farming centres, in order to avoid coastal freights and to minimize railway freights, but only at such seaports as can take vessels with a carrying-capacity of not less than 4,000 tons.

The plant at the two islands calls for some description. All the machinery is electrically driven, current being generated by powerful

Diesel engines. The fitting-shops are complete and serviceable ; casting is done, and the 15 horse-power oil-engines used in the launches are made on the island. There is a complete condensing plant capable of supplying the inhabitants with fresh water in the event of a drought, and a very serviceable refrigerating plant. The jetties are steel cantilever structures, projecting out beyond the edge of the reef in order that the lighters may be loaded outside the surf, which is sometimes very high. There are powerful wireless installations at each island, under the control of the authorities, the Nauru plant having been erected by the Germans. It is found that " wireless " is of the greatest service in connection with the phosphate operations.

A white staff of about sixty-five is employed on each island, the various departments (not necessarily in order of importance) being the medical, marine, civil engineering, mechanical and electrical engineering, accountancy, storekeeping, and analytical. Many of the staff have their wives and families with them, and everything possible in reason is done for their comfort. The element of recreation is well to the fore ; there are tennis-courts (sometimes lit by electricity for night playing), billiard-tables, cinema-shows, &c. Not the least is the talent among the staff, and many visitors to both islands have been surprised and pleased at the concerts and entertainments. An open-air theatre is used for the purpose ; the performers have a suitable stage, while the white audience sits outside. The Natives and others are usually allowed to attend, and altogether it forms a picturesque scene.

The labour force on each island ranges from seven hundred to one thousand. As far as possible, Kanakas from the neighbouring groups are used, but there are not enough available, and the deficiency is made up with Chinese, who have proved very suitable for the land work, while the Kanakas excel at the boat work. The conditions under which these labourers are employed are pronounced excellent by competent authorities. The local Government representative naturally keeps in close touch with everything pertaining to their welfare, and when the men's term of service expires quite frequently many of them sign on for a further term. The Chinese are, of course, kept away from the Native villages, and their general behaviour is very good. The Nauru Natives have recently been encouraged by the Administrator to work at the phosphate, and this should have an important bearing on their future. Throughout the Pacific it has been found that where a Native community does an ordinary amount of work its numbers do not decrease, and sometimes increase. When the Natives are content to live on what a bountiful Nature supplies, practically without doing any work, they die out.

OCEAN ISLAND.

Ocean Island, or Paanopa, an incorrect rendering of the native name Banaba, was discovered by the ship " Ocean " in the year 1804. It is about six miles in circumference, and roughly oval in shape, somewhat resembling an oyster-shell—in fact, among some of the London business men who quite approved of the dividends derived therefrom it was commonly called " the oyster." The island when first sighted from the sea looks like a green mound ; the height of the central tableland is about 265 ft., and from this it slopes more or less gradually to the coast, which in most places consists of rough coral

limestone cliffs from 10 ft. to 25 ft. high. In Home Bay there is a very useful stretch of sandy beach, which has always been a favourite place with the Natives for launching their canoes. In various parts of the island terraces are plainly discernible, indicating the stages at which it has been raised to its present height.

As with Nauru, very little has been written about Ocean Island prior to the starting of phosphate operations. The earliest account we have is a chapter in an interesting book by the late John Webster, "The Last Cruise of the Wanderer." This vessel was an armed yacht owned by Ben Boyd, formerly Lord Mayor of London, who seems to have had some visionary ideas about founding settlements in the Pacific. He called at Ocean Island in 1851, and Mr. Webster graphically describes the visit. An interesting relic of the cruise is to be seen at Albert Park, Auckland, in the shape of a brass cannon of French manufacture,



STEEL CANTILEVER JETTIES AND PHOSPHATE-BINS AT OCEAN ISLAND.

which was the long-tom on the yacht, and is said to have originally been captured at Waterloo. From Mr. Webster's account it appears that there were then about two thousand Natives on the island, and judging from the remains of old villages still to be seen there must have been some such number. Later on the island became a favourite calling-place for whaling-vessels in search of fresh provisions, and, unfortunately, disease was taken ashore, which greatly reduced the population, while numbers left at any opportunity that offered for lands where life was not so rigorous. In 1900, when operations were started on the phosphate deposits, one of the first concerns of the company was to take in hand the existing disease among the Natives, with most successful results. At the present time they number a little over four hundred, and appear to be holding their own. The island was evidently peopled from the Gilbert Group, about 250 miles to the eastward, where the Natives are of a similar type and talk the same language. In that latitude the equatorial current runs very strongly

to the westward, and many canoes have been swept away from the Gilberts, in which case they had a chance of bringing up at Ocean Island, or Nauru, where there are still some descendants of Gilbert-Islanders.

About thirty years ago a Native teacher was landed on the island by the American Board of Foreign Missions, and before long most of the inhabitants had embraced Christianity. When the writer went there in 1900 there were still a good many "begans" (pagans), but the behaviour of the whole community was quite changed from their previous thievish reputation, and they were remarkably honest. The Native teacher who was then there, Taremon (Solomon) by name, remained on the island for many years before returning to his own island in the Gilbert Group, and by his faithful work and consistent life was much respected by all.



ENGINEERING-SHOP AT OCEAN ISLAND.

The Natives are a brown-skinned, straight-haired race, not so heavily built perhaps as the Nauruans, but strong and active. Their island contains comparatively few coconut-trees, and has been subject to very severe droughts, when no vegetable food was available. They were then thrown back on the sea for their food-supplies, and in all probability are about the most skilful fishermen in the Pacific. The element of sport does not come into their minds, and one of the many things they cannot understand about the white man is that he goes out fishing when not requiring fish for food.

During severe drought-times the Natives were hard put to it for supplies of drinking-water. There are no wells, as at Nauru, and it was the duty of the women every morning to visit caves in the interior, with torches and baskets of coconut-shells. Little pools of water are found here and there in the caves, from which the coconut-shells were filled, but during drought they gradually dry up. The Natives say

that at such times they often used to go out catching flying-fish, just for the sake of the moisture contained in the aqueous humour of their eyes, which are particularly large. Naturally, fear of droughts was always present in their minds, and, when they were first told that the company would bring labourers from other places to work the phosphate, one old chief promptly asked, "What will they drink?" The modern Ocean-Islander with his cistern or tanks is well off for water ordinarily, and during drought-times can, of course, obtain supplies from the condensers.

A great change has come over the circumstances of the Natives since phosphate operations were started in 1900. They were then probably the poorest Native community in the Pacific—so poor that there was not even a "beach-comber" living among them; the prolonged droughts had frightened them away. They are now quite well-to-do, and it may be mentioned that during the war they contributed £1,000 in a lump sum towards the Prince of Wales's Relief Fund.

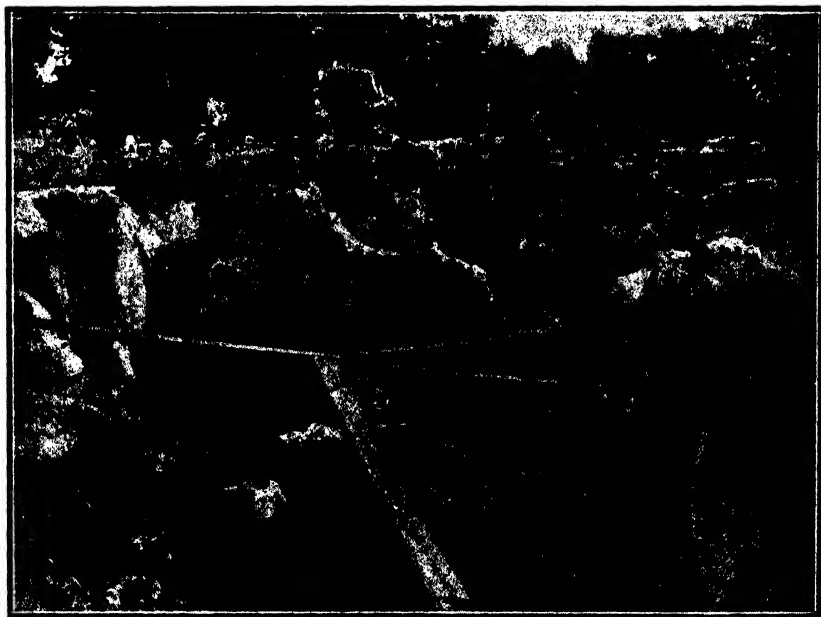
Ocean Island had not been considered of sufficient importance for any of the Powers to occupy it, but in view of its new-found wealth, combined with the urgent representations of the directors of the Pacific Phosphate Company, the Imperial Government decided to do so, and on 28th September, 1901, H.M.S. "Pylades," under the command of Captain (now Admiral) Tupper, called, and the flag was hoisted with all due ceremony.

Regarding the total quantity of phosphate on Ocean Island, as previously explained, one can make only approximate estimates. Probably 30,000,000 tons are available, but this quantity, like the figures mentioned for Nauru, may be much exceeded. The deposits exist over the whole island; the houses are built on phosphate; the roads consist of the same material, and the railway-lines are ballasted with it. The best deposit is on the central tableland, where it is of phenomenal quality and depth. Cargoes taken from there run from 87 to 88 per cent. tribasic phosphate of lime, and a depth of 40 ft. to 50 ft. is not unusual. The material is run down from the tableland by self-acting tram-lines to the driers and bins situated close to the inner end of the jetties. The main storage-bin has a capacity of 50,000 tons. In other ways the process of handling the phosphate is much the same as at Nauru.

The acquisition of Ocean Island by the three countries, in addition to Nauru, will be an important factor in the future, as the two islands work well together. In ordinary fine weather Nauru is the better place for quick shipping, but the opposite is the case under adverse westerly weather conditions, when Home Bay, at Ocean Island, proves a very valuable asset in getting vessels loaded and away. The plant at Ocean Island is quite an elaborate one, and up to 210,000 tons have been shipped in one year, a figure which Nauru has not as yet reached.

It is interesting to look back to the time when the first shipments took place, and when an incident happened which demonstrated the truth of the saying, "Bad beginnings make good endings." The first jetty, a wooden structure, had just been finished, also a tram-line leading down to it at a steep grade. The time had come to test the work, and the result was somewhat anxiously watched by a small knot of whites, also by a large crowd of Ocean-Islanders, who had collected from all parts to see the wonderful things that the white man

was going to do. The first truck, loaded with 2 tons of phosphate in bags, was started off for the jetty; it took the down grade with unexpected momentum, went with its contents like a streak along the jetty and right over the end into deep water. The feelings of the white men can be imagined, but it was a joyous episode for the Ocean-Islanders and other Native labourers. They have a keen sense of humour, and many of them fairly rolled about the ground in their mirth. Any readers who may be discouraged over a bad start when they have something big on hand may be cheered up on reflecting how the first truck-load of phosphate left Ocean Island.



WORKED-OUT PHOSPHATE-FIELD AT OCEAN ISLAND, SHOWING THE CORAL PINNACLES LEFT BARE.

The labourers employed on Ocean Island are mostly Kanakas from the Gilbert and Ellice Groups, and the fact that they have been the main labour force since 1900 demonstrates their suitability for the work, also the popularity of the employment with them. Many of their islands are exposed surf-bound places similar to Ocean Island, and on these the Natives are accustomed to the roughest surf conditions from childhood. This fits them in every way for the boat work at Ocean Island, and it would be a difficult matter to replace them. As at Nauru, the insufficiency of Kanakas is made up with Chinese, and the two classes of labour prove quite satisfactory. Some apprehension appears to exist in New Zealand as to the treatment and behaviour of the labourers, particularly of the Asiatics. In this connection the

following extract from an article by Mr. A. H. Mahaffy in *Blackwood's Magazine*, of November, 1910, may be quoted as being a testimony from an independent authority. Mr. Mahaffy says: "The now considerable population of the island, consisting of so many different elements, lives in wonderful harmony and peace. Crime is almost unknown, and during the six months in which I had the honour to represent the arm of the law as Resident Commissioner one solitary Court case came before me. It was the theft by a Japanese of some stores. Disturbances among the Native population or the indentured labourers are of extremely rare occurrence, and I gladly bear testimony to the very great humanity and kindness with which the officers of the company treat the mixed Native population."

The maintenance of good health on both Nauru and Ocean Islands has naturally been a matter requiring close attention, and some of the measures adopted are quite up to date. For instance, the settlements have complete systems of water-borne sewerage. Electrically driven pumps deliver large quantities of sea-water to a high elevation—at Ocean Island about 250 ft.—and this flushes the sewers. The hospitals there are on the hill, and are quite up to date. A resident medical officer is stationed at each island, assisted by a dispenser and trained nurse, who acts as matron, with Native orderlies under her control.

CONCLUSION.

It will be seen that New Zealand possesses a most valuable asset in her part-interest in Nauru and Ocean Islands, and no apprehension need be felt regarding adequate phosphate-supplies for many years to come. Not only is the quantity enormous, but the quality is of the highest grade known, a most important factor in the fertilizer trade. Another important feature is that the islands are within comparatively easy reach of New Zealand, Ocean Island being about 2,250 miles from Auckland. This means that the steamer freights should not be unduly high, while on the islands everything is being done to produce the phosphate at low cost. Everything points to the fact that as the years roll on the phosphate deposits of Nauru and Ocean Islands will play an important part in the welfare not only of the farmer, but of the Dominion in general.

Invercargill Prison Farm.—The annual report of the Prisons Department for 1919-20 states that the farm connected with the borstal institution has made steady progress, and now the whole area is ring-fenced and subdivided into grazing-areas. There were last season approximately 800 acres under grass, 40 acres in oat crops for chaff, and 40 acres in turnips for winter feed, and it was estimated to have a hay crop from 150 to 200 tons, the farm carrying 320 store stock and 92 milking-cows. An up-to-date piggery has been erected, allowing for the convenient handling of ninety pigs for fattening purposes. It will be recalled that the initial operations on the area comprising this farm were described in an article entitled "Estuary Reclamation at Invercargill: Remarkable Agricultural Conversion," published in the *Journal* for April, 1918.

THE CATTLE-TICK AND ITS CONTROL.*

A. R. YOUNG, M.R.C.V.S.; Director of the Live-stock Division.

IN New Zealand the cattle-tick (variety *Haemaphysalis bispinosa*) was first observed in the North Auckland district, where the mode of its introduction is obscure. This locality being extremely favourable for its development it readily increased, with the result that it has now spread over a large area. A line drawn from the Manukau to Mercury Bay would leave the part to the north as what may be described as tick-infested country. From there southward to a line from Kawhia to Opotiki would indicate where the ticks have been found in very isolated cases. Within the past few years the spread of the pest has been very marked, and the risk existed that unless checked it would overrun the whole of the North Island. It is satisfactory, however, to note that the settlers in the infested districts have shown a keen desire for its suppression, and have organized themselves into administrative committees with this object in view, their efforts in this direction being well supported by the stockowners of clean districts. This organized co-operation is a valuable aid to the Department in administering the regulations now in force.

Only brief remarks on the life-history of the cattle-tick need here be given.† Upon observing an infected animal a much larger number of male than female ticks will be found. The reason for this is simply that once the male gets upon the animal he is in no hurry to leave his congenial feeding-ground; but the female, immediately she becomes fertile, proceeds to engorge herself as fast as possible, and whenever this is completed she drops off upon the ground and seeks some quiet, sheltered spot where she may deposit her eggs. After resting a few days in the spot selected she proceeds to lay the large number of from one thousand to three thousand eggs; she then dies. The eggs as deposited are resistant to climatic conditions, so that they are not easily destroyed by adverse circumstances, although these would delay the hatching, which may take place within a fortnight or extend over two or three months, according to conditions. The ticks hatched are known as "seed-ticks." They are capable of lying dormant in adverse circumstances, but become extremely active whenever the weather is favourable. They can also live for some time without any food whatever. In order to secure its existence, however, the seed-tick must sooner or later become attached to a suitable host, which in this case is cattle. The tick would have considerable difficulty in reaching cattle if it depended entirely upon crawling across the ground and over the feet and up the legs, as the animal in walking about would be continually brushing the tick off its feet. To wait until it got an animal in the

* These notes are part of a lecture recently given to the Farmers' Union, New Plymouth, with the addition of plans and matters relating thereto.

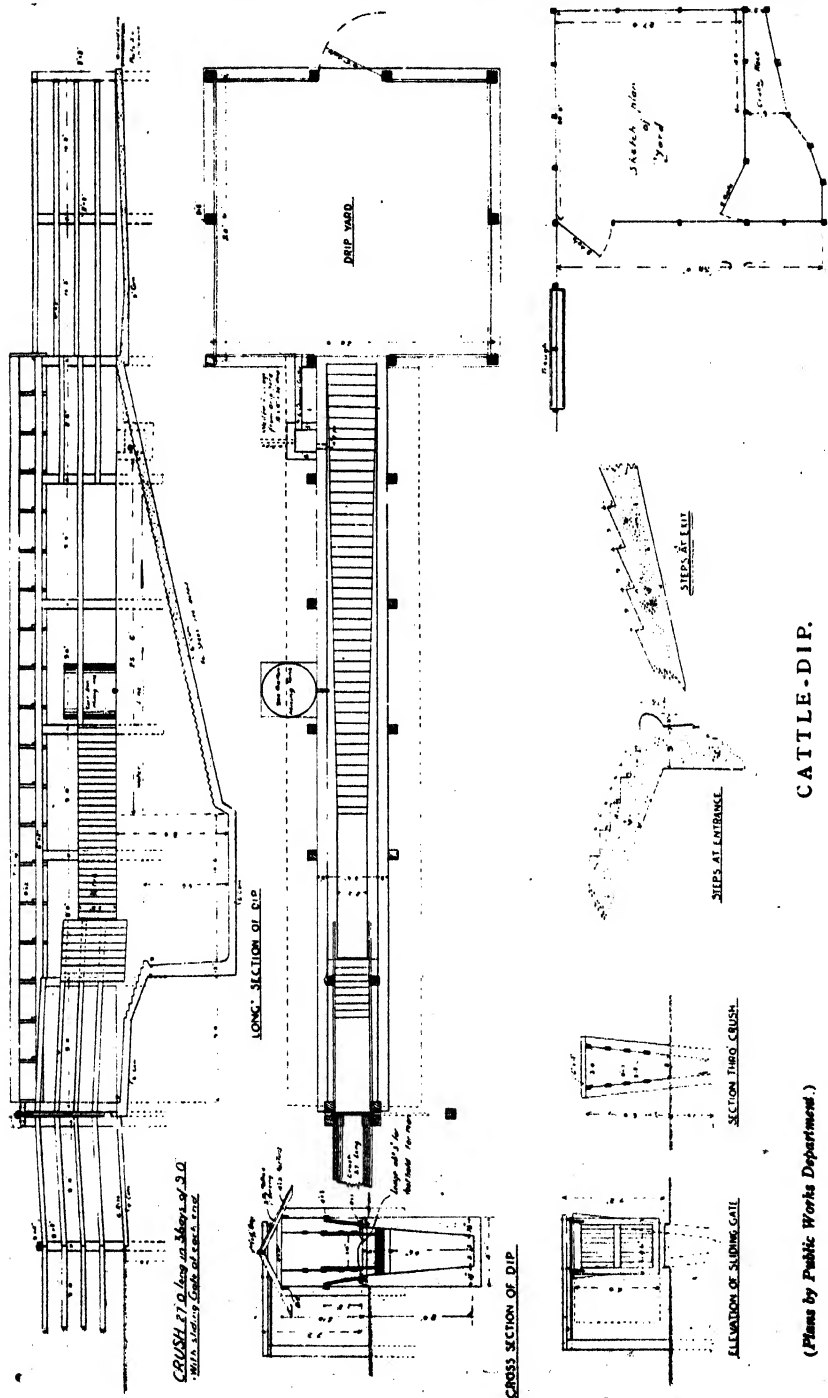
† Further information on the subject will be found in an article "Notes regarding Ticks found on Farm-animals in New Zealand," by Dr. C. J. Reakes, published in the *Journal* for February, 1918.

recumbent position would also be to reduce the tick's favourable chances for access to its host. It therefore adopts the very ingenious method of climbing upon the blades of tall grass or on any roughage which may take it to a height where it can grip on to the legs of any animal (including man) which may happen to pass by. Being of a very active nature, the ticks soon get from the legs to the body of cattle, and in a short time mating takes place, with the results already described.

Having regard to the fact that the seed-tick attaches itself to other farm-animals besides cattle, it has been often suggested that all such animals should have been included in the control regulations under the Stock Act. When it is realized, however, that seed-ticks may attach themselves to man, dogs, hares, rabbits, and even the feathered tribe—though all are really unsuitable hosts—it will be seen that to have included these would have been to lay down something which could not be enforced, even if an Inspector were placed on every farm. At the same time it is advisable that horses and dogs in the infested districts should be examined by the owners and, if found infected, given a dip along with the cattle. Another suggestion has been that a quarantine boundary-line should have been drawn; but as this was considered to be useless under the conditions already described, the regulations were so framed that any place where ticks were found automatically became an infected area. It will thus be seen that the boundary is made elastic, and that no formalities are required for extending boundaries if or when the tick finds its way into new fields. Another point is that although ticks may be disseminated by animals other than cattle they must be thus spread in considerable numbers before it is certain that they will ultimately become attached to cattle and breed. In the meantime, therefore, dependence is being placed upon the chief precautions which have already been taken, and it is strongly recommended, having regard to the habit of the seed-tick in infested places to climb upon the rough herbage, that all gullies and rough places should be periodically fired if possible. This would eliminate large numbers of seed-ticks, and possibly eggs, for the shorter the pasturage is kept the less chance is there for the tick to get attached to cattle, and if it fails in this it will, of course, die.

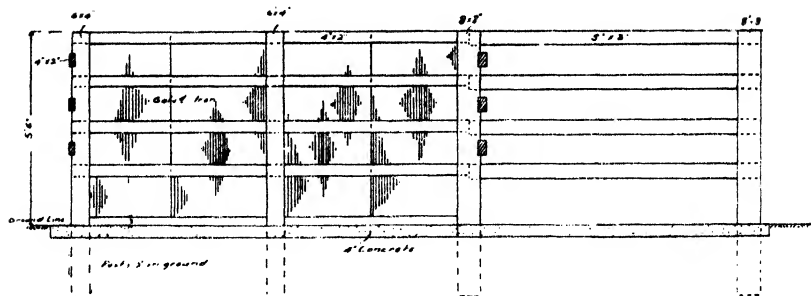
There is another tick which may be confounded with the cattle-tick, one which infests poultry and also wild feathered creatures. It is recommended that any one finding ticks of any description (excluding, of course, the so-called sheep-tick) in his locality should forward specimens to the Live-stock Division for identification.

The methods (in order of merit) adopted to eradicate or prevent the spread of the cattle-tick are dipping, spraying, and hand-dressing. Dipping is recognized as by far the most efficient method, for by this means unhandled animals can be treated just as rapidly as a docile cow. In the United States of America a tick of similar habits though of a different variety from *Haemaphysalis bispinos.* has been eradicated over very large areas by the dipping treatment. Several cattle-dips have already been constructed in North Auckland, and but for the extreme shortage of cement many more would have been in existence. More rapid work is now proceeding, and it is hoped that within a short time sufficient dips will be provided to meet all requirements. Where public dips are constructed, if the Department approves of the locality

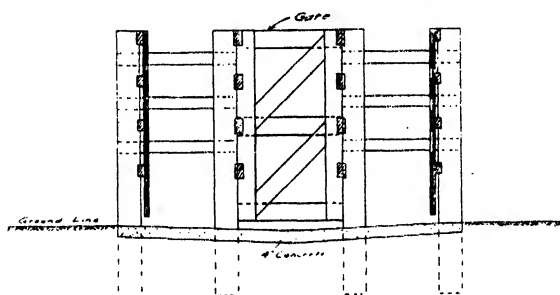


CATTLE-DIP.

(Plans by Public Works Department.)

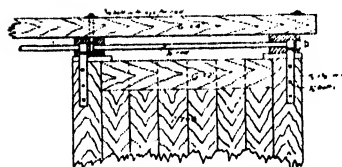


— SIDE ELEVATION —

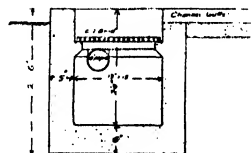
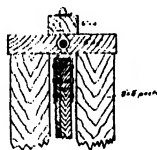


— SECTIONAL ELEVATION at A-B —

DETAILS OF SPRAY-CRUSH



TOP OF SLIDING GATE.



SECTION OF DRAINAGE WELL.

FURTHER DETAILS OF DIP.

and structure, the Government subsidizes the cost, on a pound-for-pound basis up to a limit of £150 per dip, as its share. The Government is prepared to subsidize up to forty public dips, and further provision will be made if necessary.

The Department has had plans prepared of a good standard type of cattle-dip, embodying all the latest known improvements; also plans of a spray-crush, for use where that method, which is suitable with quieter beasts such as dairy cattle, is adopted. These plans are here reproduced on a small scale for general information. Full-sized working plans, together with complete specifications, are available on application to the Live-stock Division by parties actually undertaking the construction of dips or crushes. The Auckland officers of the Division

are specially equipped for giving full information and advice on all matters concerning the cattle-tick and its control.

As regards cattle-dip preparations, stockowners should see that they obtain a reliable brand. Great care is necessary in mixing small quantities of dip for spraying, cases having occurred recently in which cattle have been injured by scalding due to the preparation having been used considerably over strength. Farmers are advised to apply grease or oil to the teats of dairy cows before these animals are dipped or sprayed, in order to prevent irritation of those parts.

The cattle-tick regulations were framed and gazetted last year to assist the farmer in eradicating the pest and to protect clean districts. A copy can be had on application to any Inspector of Stock.* The regulations prohibit the sale or movement of cattle harbouring ticks, and a perusal of them will show that great care has been taken to bring all possible avenues of spread into their scope. Two of the sections may be quoted with a view to showing some of the restrictions placed upon the movements of stock, as follows :—

Every person who, by himself, his agent or servant, drives, without permission of the Inspector, any stock affected with cattle-ticks across or upon any land, or drives, depastures, or suffers to stray any such stock upon or along any highway, is liable to a fine not exceeding £50 and not less than £2 for every day during which such stock are so driven, depastured, or suffered to stray.

No cattle shall be shipped from any port in the North Island unless they have been first examined by an Inspector and declared to be free from infestation by cattle-ticks.

Thus it will be observed that no cattle can be removed from any infected place—neither by road, railway, nor sea—until a clean certificate has been granted. It is also absolutely prohibited to expose for sale or exhibition any stock affected with cattle-ticks.

* The full text of the regulations was published in the *Journal* for October, 1919.

Laying Concrete in Water.—When laying concrete in water it is necessary to check any flow of water round the concrete, use a richer mixture than would be used for outside work, and deposit with great care to avoid the cement being washed out. We do not know of any material that can safely be used to accelerate the setting of concrete under water.—*Public Works Department.*

Deer and Forestry.—"In both the Rotorua and Tapanui districts," states the last annual report of the Forestry Department, "deer have become a serious nuisance in the plantations, and though forest officers are permitted to shoot them in the plantations it is both difficult and expensive to keep these pests in check. Dr. Sommerville has shown that in the Scottish Highlands deer have in many localities, by eating the seedlings, completely prevented the regeneration of Scots pine. These animals are likely to become a serious trouble in our own native forests as soon as management operations are started in them, and it will be necessary to take strict measures to control them."

AN ECONOMIC INVESTIGATION OF THE MONTANE TUSSOCK-GRASSLAND OF NEW ZEALAND.

IX. FURTHER DETAILS REGARDING THE EARNSCLEUGH (CENTRAL OTAGO) PALATABILITY EXPERIMENT.

DR. L. COCKAYNE, F.R.S., F.N.Z.Inst.

GENERAL.

IN the October number of this *Journal* a general account was given of an experiment conducted on the Earnsclough Experimental Area, near Clyde. Here, in order to bring out more fully the results of the experiment, an account of the behaviour of each species is given. Also, in some cases a comparison is made with the behaviour of a species during the previous Hanmer experiments; and, if sufficient facts are available, something is said as to its palatability as revealed up to the present by the general field observations. Thus, if the experiences of arid Central Otago confirm those of Hanmer—a much wetter locality—and the South Island sheep-runs generally, it seems clear that an accurate estimate of the relative palatability of the species in question may be considered well on the way to be established. On the other hand, where differences occur, more attention as to their palatability must evidently be paid to such species.

In a considerable number of cases the notes given below refer only to the Central Otago experiment. It must therefore be plainly understood that whatever is said as to the palatability of these species refers to the Earnsclough (Central Otago) experiment, and to it alone; so no general applicability is claimed, but quite the contrary. But, as Central Otago and the adjacent dry area to the north present their own peculiar problems for solution, the evidence derived from the Earnsclough experiment stands by itself as of special value.

It will be seen that the species are put into five classes. This classification, again, refers only to the results of the Earnsclough experiment. It is certain that some of the species would have come into a different class had the experiment been conducted at a different season or in a locality with a wetter climate. Also, an attempt is made to arrange the species according to the degree of the palatability of each; but this, again, refers only to the Earnsclough experiment, while such arrangement is quite tentative.

NOTES REGARDING THE PALATABILITY OF EACH SPECIES.

CLASS I. SPECIES OF HIGH PALATABILITY.

Cocksfoot (Dactylis glomerata).—There were two classes of cocksfoot in the pasture—namely, young growth about three months old resulting from cutting part of the sown area for hay, and tall tussocks of hard stems with more or less green leaves near their base. These cocksfoot tussocks, some of which had been grown from seed sown some seven or eight years before, were extremely vigorous, notwithstanding that they

were situated on a steep extremely dry hillside, where there had been virtually no rain for more than four months. Nor had they been grazed, except by a few rabbits, or cut during the period of their existence.

As soon as the sheep were let into the enclosure they commenced eating the young growth of the plants which had been mown earlier in the season, and this they continued doing day by day, until by the end of the eleventh day virtually all was eaten to the ground. The only other competing plant at the commencement of the experiment which was freely eaten in the presence of leaves of cocksfoot four months old was lucerne of the same age. It is hard to say which of the two was preferred; if anything, perhaps cocksfoot takes first place. The young cocksfoot of the sown area also came into competition with old uncut cocksfoot tussocks. These, in its presence, were untouched. This was also the case with old lucerne, though the leaves of such were occasionally eaten.

More interesting than the continuous grazing of comparatively young cocksfoot, especially as concerns Central Otago, is the fact of the high palatability of old plants in seed. These were eaten readily as soon as the sheep spread from the mown plants on to the uncultivated slopes. Throughout the grazing-period, except during the first few days, cocksfoot tussocks were being regularly eaten, the greener leaves first and then the dry leaves and stems. Figs. 2 and 4 of the preceding article (October, 1920) show clearly enough that if the experiment had been carried out for a few days longer *all* the cocksfoot, even the driest stalks, would have been eaten to the ground.

The conditions under which these uncut old plants were growing must be understood in order that the value of cocksfoot as a pasture-plant for Central Otago may be fully estimated. The slope where the greater part grew was extremely steep; the roots of the plant were about 2 ft. long, and the soil at much less than that depth was apparently extremely dry. Judging, for instance, from an examination of the soil of the Clyde Hospital grounds at a depth of 2 ft. and upwards, the amount of moisture in the Earnsclough soil at a depth of 2 ft. can hardly have exceeded 4 per cent.

As for the relative palatability of dry cocksfoot, it certainly stood far higher than any of the species here put under the head of "medium palatability." Its palatability-value as compared with that of dry lucerne and catsear is dealt with below.

Long before the experiment was concluded, notwithstanding the dryness of the ground, some of the earlier-eaten plants had put forth new leaves more than 1 in. in length. It is certainly of importance to have learnt that dry, coarse, large cocksfoot tussocks, believed by many to be of but little value for feed, were readily eaten, and that close feeding apparently did no harm; and also that cocksfoot grows luxuriantly under the most arid conditions which New Zealand can offer. It now remains to discover the cheapest methods of establishing this splendid grass on the depleted hillsides. Will surface-sowing alone suffice, or must methods of getting the seed more or less covered by soil, &c., be used—*e.g.*, harrowing, or trampling by sheep? The experiments of the Department of Agriculture, on the Dunstan Mountain, now well in hand, ought before long to give some definite answers to these questions.

Lucerne (Medicago sativa).—Much that has been already said about cocksfoot applies to lucerne. There was both growth about three

months old and uncut plants 2 ft. to 3 ft. high which had been established from seed for about eight years. Also abundance of hard, dry stems, left behind after the lucerne-cocksfoot hay had been taken away, lay upon the ground. The young lucerne, as already explained, together with the young cocksfoot, was eaten at once. As for the old plants, the leaves were eaten first of all and the stems left standing. But by the eleventh day the upper parts of the stems had been eaten, while the lower parts were still affording food. The dry stalks lying on the ground were also eaten freely (see Fig. 1). Some days before the sheep were removed virtually all the tall lucerne was eaten to the ground; indeed, many of the plants were so closely cropped that it looked as if they would not recover. But this was not so; some were putting forth new growth in the presence of the sheep, and, so far as I can judge, not one plant has been killed through the heavy grazing.

Before leaving this matter of the lucerne it must be pointed out that the plants of the experimental area had been established by rather shallow cultivation—i.e., they had not been dealt with on the principles of dry-farming—and that they had grown vigorously for about eight years without any water other than what they got by means of their deep rooting and from the occasional rain. Certainly the behaviour of this most valuable pasture-plant demands that it should be tried in experimental seed-mixtures for depleted ground.

Red Clover (Trifolium pratense).—There was not a great deal of red clover on the Earnsclough area, while all there was occurred on the sown ground. On the first day of the experiment the seed-pods were freely eaten by such sheep as had wandered from the lucerne-cocksfoot. By the eighth day all the red clover had been eaten.

Owing to the small quantity of this plant it was not possible to truly estimate its relative palatability, but it was probably quite equal to that of the uncut lucerne. On several occasions it was eaten in the presence of cocksfoot; and, at first, yarrow was not eaten in its presence.

Alsike (Trifolium hybridum).—There was very little of this species. It was not eaten at all until the second day, when the seed-pods were completely demolished. By the eighth day the stems and leaves were all eaten and fresh growth was appearing. The species evidently is greatly relished. Though established on the Earnsclough area as early as any of the species it has not increased through natural sowing.

Sheep's Burnet (Poterium Sanguisorba).—There was a good deal of this plant here and there in the sown ground, as well as abundance in its original rows, also a certain amount had established itself on the lower slopes of the hillside. The leaves were eaten more or less on the first day of the experiment. On the eleventh day the lower part of the stalks still remained uneaten.

Catsear (Hypochoeris radicata).*—As numerous field observations have shown that catsear is one of the very first plants eaten by sheep grazing naturally throughout the South Island runs it was of special interest to note its behaviour during the Earnsclough experiment. It was extremely abundant on the driest, most sunny slopes, where it had

* Catsear is distinguished from dandelion (*Taraxacum officinale*) by its bristly (not smooth, hairless) leaves, branched solid (not unbranched, hollow) flower-stalks, and smaller flower-heads than those of the dandelion. By many it is known as "capeweed."

EARNSCLEUGH PALATABILITY EXPERIMENT.



FIG. 1. SHEEP EATING THICK DRY STALKS OF LUCERNE ON THE EXPERIMENTAL AREA



FIG. 2. VERY DRY MEADOW-GRASS (*POA PRATENSIS*) EATEN TO THE GROUND IN THE PRESENCE OF DRY COCKSFOOT.

[W. D. Reid, photos.]

naturally occupied not merely the depleted ground—that portion most difficult of all to recolonize—but had also gained the sown area, and was likewise in great quantity in the small enclosure.* From the foregoing it can be seen that catsear came into competition with a large majority of the pasture-plants.

At the time of the experiment the catsear-plants looked at their worst so far as palatability was concerned. The rosettes of leaves, smaller and less succulent than when growing in a wetter climate, were more or less burnt up, but there was an abundance of dry flower-stalks and seed-heads (see Fig. 1 in article viii of this series). All the same, the species was eaten constantly throughout the experiment, until not merely none remained, but in places where it had been thickest hardly a trace was to be seen, even the roots themselves being demolished.

As for the actual palatability-value of catsear, it is not easy to define its status. Certainly it does not come far from being equal to cocksfoot in general, and quite the equal of old cocksfoot in the coarse tussock state. In the small enclosure, though a certain amount of cocksfoot was there also, catsear was the first plant to be eaten. So, too, on the hillside it was frequently observed to be eaten in the presence of cocksfoot, and at times in the presence of old lucerne. On the sown ground at the end of the first week it had been grazed on to a considerable extent, but a large amount still remained.

Yarrow (Achillaea Millefolium).—The behaviour of yarrow stands by itself in the Earnsclough experiment. What its actual palatability-value is I am not in a position to state. It was not until the fourth day of the experiment that yarrow was attacked; but once eaten the plant was not let alone until all was demolished, and even the underground stems laid bare and partly eaten. By the end of the ninth day all the yarrow in the pasture had been disposed of, except the green leaves and the young growth. Green yarrow, in fact, is apparently much less palatable than that which has been dried up, the green leaves having been severely let alone until the dry parts of the plant were consumed. How palatable yarrow becomes for sheep as soon as they commence feeding upon it is shown by the fact that on the first day it was eaten the following highly palatable species, *it being present*, were neglected: Cocksfoot, catsear, sheep's burnet, and lucerne.

How far yarrow is a nutritious food I do not know for certain. Its aromatic character has earned for it the reputation of being valuable medicinally, and so of special use in pastures. Be this as it may, it is the value of the plant as a *food* which concerns this article. The most suggestive information on this head is with regard to a North American species, *Achillaea lanulosa*.† This plant, blue foxglove‡ (*Penstemon procerus*), and sweet sage (*Artemisia discolor*) are the leading

* Those who have read the former article dealing with this experiment may remember that three-fifths of an acre, called "the small enclosure," was fenced off from the rest of the area.

† See A. W. Sampson, "Plant Succession in relation to Range Management," U.S. Dept. Agric., Bull. No. 791, Washington, 1919.

‡ This must not be confused with the foxglove (*Digitalis purpurea*), one of the noxious weeds of New Zealand. Popular names of plants are frequently, as in this case, most misleading, for a valuable plant, judged by its popular name alone, might easily be looked upon as dangerous in a pasture; while, *vice versa*, a most harmful plant, bearing the same name as one well known to be beneficent, might readily be warmly welcomed.

plants in the second stage of deterioration of the primitive pasture of the highlands of Utah. Now, according to Sampson (*l.c.*, p. 70), sheep make rapid gains on the "foxglove-sweet-sage-yarrow" pasture "early in the season when the herbage is succulent and tender." He also states that the palatability for sheep of the yarrow is high, and that of the two other dominant plants is medium, while of the total flora of twenty-seven species only five others are of high palatability. Thus it seems that this American species of *Achillaea* is not merely palatable, but possesses considerable fattening-qualities.

Birdsfoot Trefoil (*Lotus corniculatus*).—There was very little of this in the pasture, but one large plant was especially conspicuous. This was slightly eaten on the second day of the experiment, and by the eleventh day all the leaves and young growth were gone, but apparently the stems have a much lower palatability.

Chicory (*Cichorium Intybus*).—The sheep commenced eating the chicory, of which there was a good deal in some parts of the sown ground, on the fifth day of the experiment. The leaves alone were eaten. By the eleventh day there remained only the dry stalks and a small amount of young growth.

Sainfoin (*Onobrychis viciæfolia*).—There was very little sainfoin. It was eaten to some extent on the second day of the experiment, and by the eleventh day it was stripped of leaves, but the stems were uneaten.

Sowthistle (*Sonchus oleraceus*).—This was not abundant, but what there was had come spontaneously. By the eleventh day both stems and leaves had been closely eaten.

Woodrush (*Luzula campestris* var.).—*Luzula campestris* is a species found in all temperate regions of the earth, but it consists of many distinct varieties, some of which are confined to New Zealand. These varieties are difficult to distinguish; indeed, the group is but little known as yet. What concerns this article is that the plant of the Earnsclough area is of high palatability, for, wherever it occurred, it was early eaten to the ground. As different forms of the species grow naturally in all the tussock pastures, it is evident that more should be learned about them from the economic standpoint.

CLASS 2. SPECIES OF MEDIUM PALATABILITY.

*Rib-grass** (*Plantago lanceolata*).—There was but little of this plant, though it might well have been expected to have spread considerably. I have no record of when it was first attacked, but by the eleventh day the leaves had been closely eaten, while flower-stalks and seed-heads remained untouched.

Meadow-grass (*Poa pratensis*).—Hardly any green leaves remained in the patches of this grass; it was burnt up to the last degree. Notwithstanding its apparently unpalatable condition it was eaten to the ground by the seventeenth day. In one place where it had been greatly eaten dry cocksfoot still remained uneaten (see Fig. 2), and, in another place, dry Yorkshire fog.

Although here meadow-grass is classified as a plant of medium palatability, this only refers to the plant when dried up. The first experiment at Hanmer showed that, in the presence of cocksfoot, it was completely eaten before the cocksfoot was touched, although when

* "Rib-grass" is not a grass. Ribwort, another of its names, would be more suitable and not misleading.

meadow-grass was absent cocksfoot took first place among all the other species. The field observations constantly record that meadow-grass is eaten first of all. If one sees sheep grazing on the ordinary tussock pasture, in a large majority of cases it is either meadow-grass or catsear which is being eaten.

Yorkshire Fog (Holcus lanatus).—There were both fairly green plants and those with stout dried-up stems and withered leaves. Green plants were eaten at times from about the fourth day, and before the close of the experiment such were disposed of; but although the dry plants were eaten to a limited extent many of these were untouched when the sheep were removed. The results, so far as green plants go, show a slighter degree of palatability than has been shown for this species when grazed by sheep in the open.

Chewings Fescue (Festuca rubra var.).—There was a good deal of this grass, both more or less pure or mixed with red fescue, or dotted about among other plants. It was sparingly eaten on the fifth day, and from that time onwards, when the more palatable plants in the vicinity had been eaten to the ground, the Chewing fescue received a good deal of attention until the conclusion of the experiment.

It is highly interesting to have procured some definite information regarding this grass. In the first article of this series I wrote (this *Journal*, January, 1919, p. 5): "Two sheep-farmers, both men of the greatest experience, expressed to me totally divergent views as to the value of Chewings fescue, the one asserting that sheep hardly touch it, and the other that it was a valuable feed." It is satisfactory, then, to know that in Central Otago, after some months' drought, this grass was eaten to a considerable extent by sheep which were far from being hungry. The point has been reached, in fact, for further observations, and a knowledge of its true value for mountain sheep-runs should not be difficult to ascertain.

Hooked Sedge (Uncinia sp.).—Long before the conclusion of the experiment such plants as were present both on the sown area and the slopes were eaten to the ground. My notes do not tell the date of the commencement of the eating. Various species of *Uncinia*—all indigenous New Zealand plants—are more or less common in montane tussock-grassland, and their behaviour needs careful watching.

Thick-stemmed Broom (Carmichaelia Petriei).—Possibly this species should come in the next class; but the plants were fairly tall shrubs, which could be reached only by sheep standing on their hind legs. There were only a few plants, and these competed chiefly with the three indigenous tussock grasses. That this broom is put into Class 2 rather than into Class 3 is owing to its being much more difficult of access to the sheep than is blue-grass, for instance. All the New Zealand brooms which occur in the sheep-pastures are palatable, but they do not generally occur in sufficient quantity to be of much moment. Where exposed to the full attack of both sheep and rabbits the thick-stemmed broom is eaten to the ground, and frequently killed outright, but where sheep and rabbits are excluded a damaged plant soon regains its full size.

Tall Fescue (Festuca gigantea).—There was only a little of this species. Before the close of the experiment it was eaten to the ground. Its exact position with regard to palatability I cannot state. Although a bad weed in moist ground in the North Island, it may prove a valuable grass for the depleted areas.

EARNSCLEUGH PALATABILITY EXPERIMENT.

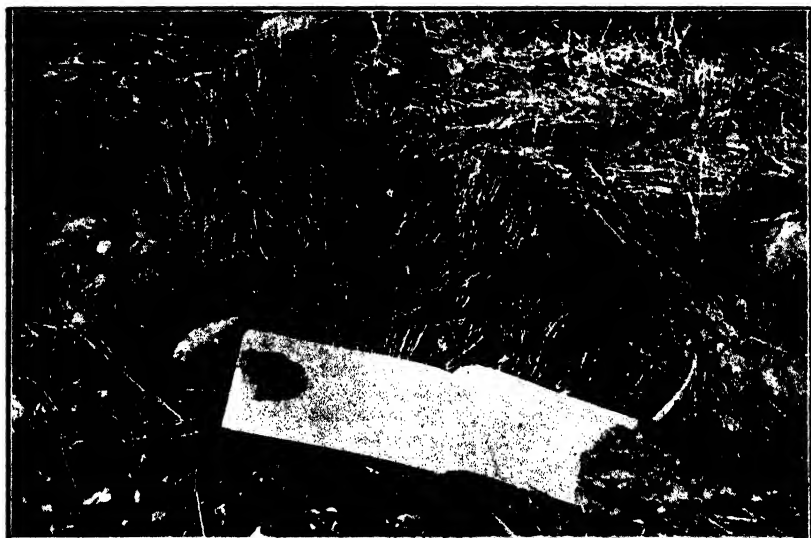


FIG. 3. BLUE-GRASS TUSOCK WHICH HAD BEEN FREELY EATEN IN THE PRESENCE OF TALL BLUE-TUSOCK THAT HAD BEEN HARDLY TOUCHED (THE LATTER NOT SHOWN IN PHOTO).

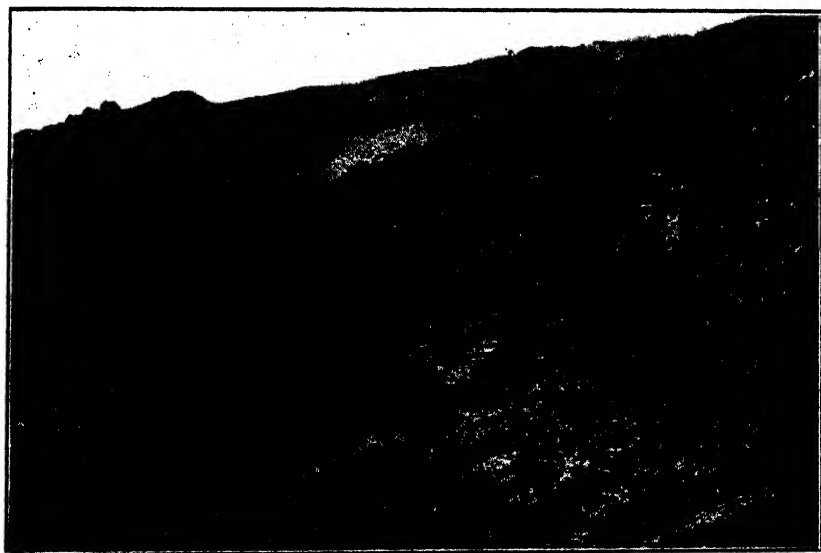


FIG. 4. PORTION OF THE SMALL ENCLOSURE, SHOWING THE ABUNDANCE OF BLUE-GRASS AND TALL BLUE-TUSOCK REMAINING AFTER THE HEAVY STOCKING TO WHICH THIS AREA WAS EXPOSED

[W. D. Reid, photos.]

Carex Colensoi.—This little sedge—for which no popular name has yet been coined—was eaten closely, but I have no exact details.

CLASS 3. SPECIES OF LOW PALATABILITY.

Sorrel (Rumex Acetosella).—The position of sorrel in the results of the Earnsclough experiment is certainly not its true place, its palatability in general being far higher. There was not a great deal of sorrel in the pasture. The sheep commenced eating it early, but throughout the experiment it was not greatly eaten, though it was easy to overlook plants in this regard.

Small Vetch (Vicia sp.).—The small amount of this plant present was extremely dry. By the eighth day it had not been eaten to any extent, but by the eighteenth day it had been greatly eaten.

Blue-grass (Agropyron scabrum).—There are many forms of blue-grass, even in the neighbourhood of Clyde. A form with narrow leaves is abundant on the Earnsclough area. The blue-grass grew under these three conditions with regard to competing plants: (1) On the cultivated ground, it having come there spontaneously; (2) on the sunny slopes, where it was dotted here and there; and (3) on the dark faccs of the gullies, where it came chiefly into competition with tall blue-tussock and, to a lesser extent, with fescue-tussock. In situation (1) for a long time the blue-grass was untouched, as it came into competition with most of the plants of Class 1 (high palatability). For instance, on the nineteenth day the tussocks of blue-grass were generally only slightly eaten, but all the accompanying plants were gone. From that time onwards, however, these tussocks were freely eaten, and many were cropped close to the ground (see Fig. 3) by the time the sheep were removed. In situation (2) blue-grass was cropped earlier than in situation (1), but rarely was a tussock more than partially eaten. Even at the close of the experiment many of the tussocks still offered abundant feed. In situation (3) the blue-grass was more closely cropped than elsewhere.

To sum up, the experiment has clearly shown that blue-grass, though not of anything like the same degree of palatability as the plants of Class 1, is nevertheless readily eaten by well-fed sheep when in competition only with such grasses as are usual in tussock-grassland, and that an increase in the amount of blue-grass in the montane tussock-grassland generally would greatly improve the pasture.

Red Fescue (Festuca rubra var.).—Red fescue was one of the species which were originally sown on the cultivated ground both in rows and as a constituent of certain mixtures. It was also in more or less abundance on the uncultivated slopes, where it either established itself spontaneously or had come from seed sown broadcast. It forms tussocks after the manner of the indigenous fescue-tussock, but smaller.

Compared with its relative, Chewings fescue, it is of considerably lower palatability. At the conclusion of the experiment a good deal of red fescue remained with the tall dry stems usually untouched. It was especially eaten where it formed a pure pasture. On the final day of the experiment a considerable number of readily accessible plants were not eaten at all.

Compared with blue-grass, red fescue, according to this experiment, appears to be somewhat less palatable, but the evidence procured was conflicting.

Barley-grass (Hordeum murinum).—This was only in small quantity. The sole note I have regarding this grass was taken on the nineteenth day; it says, "*Hordeum murinum* eaten to the ground."

In late winter, when young, barley-grass is quite an important food of the depleted country, especially in gullies.

Tall Blue-tussock (Poa intermedia).—This indigenous grass showed considerably lower palatability than blue-grass. Nevertheless, long before the blue-grass in its vicinity was eaten to the ground blue-tussock was eaten more or less, and occasionally closely. Young plants, or youngish leaves after burning, possess a much higher palatability. In the small enclosure, notwithstanding the heavy stocking, much of this grass remained untouched at the conclusion of the experiment (Fig. 4).

At the present time tall blue-tussock is the dominant grass of the dry portion of Central Otago above 2,500 ft. altitude. It is therefore of considerable interest to have learnt something definite regarding its palatability.

Sweet Vernal (Anthoxanthum odoratum).—There was a fair amount of sweet vernal, mostly with dried-up leaves and stems. Where there were green leaves these were eaten to some small extent. In general the plant was hardly touched.

In spring, when tender, as the second Hanmer experiment showed, sweet vernal under heavy grazing is eaten to the ground and possesses a much higher palatability than blue-tussock (*Poa Colensoi*), a very near relative of tall blue-tussock.

Winged Thistle (Carduus pycnocephalus).—There were only the dry, hard stems of this plant remaining. In the small enclosure these were more or less eaten after some time.

Smooth-leaved Mullein (Verbascum Blattaria).—This was eaten slightly from the seventh day of the experiment, but, generally speaking, the amount eaten was almost negligible. This result is at variance with certain field observations made at Hanmer and near Lindis Pass.

White Clover (Trifolium repens).—There was very little white clover. It was apparently only eaten to a small extent, but I have no definite notes on this matter.

The question of the palatability of white clover for sheep requires special investigation. Up to the present the evidence is mostly against its being other than a plant of low palatability.

Perennial Rye-grass (Lolium perenne).—This grass was only in limited quantity and greatly burnt up. Of course, in ordinary pasture in a wetter climate it would have come in Class 1. By the thirteenth day the few green leaves had been slightly eaten, but at the end of the experiment the dry leaves were still untouched. Evidently dried-up rye-grass is not nearly the equal for palatability of dried-up meadow-grass.

Odorous Tree-daisy (Olearia odorata).—This shrub was eaten to some small extent. It is usually not in sufficient quantity to be of any moment.

Hawksbeard (Crepis capillaris).—This species, which field observations have suggested was of high palatability, was eaten only to a limited extent, and then mainly the seed-heads. Catsear, in its presence, was eaten freely.

Fescue-tussock (Festuca novae-zelandiae).—There was not nearly as much of this—the dominant tussock of South Island montane grass-land—as of blue-grass or tall blue-tussock. But besides the plants

which, together with the two last-named grasses, had come spontaneously on the dark faces of the gullies there was one row which had been raised from seed. This was still intact at the conclusion of the experiment (see Fig. 3, p. 181, this *Journal*, October, 1920). Also, elsewhere, except with quite young plants, fescue-tussock was hardly touched.

This experiment, then, confirms the experience of the two former experiments and of many field observations, that fescue-tussock, except when young, or its young leaves after burning, is worthless as food for sheep.

Tall Oat-grass (Arrhenatherum elatius).—Even the young leaves after cutting were hardly eaten. The dry stalks were altogether neglected, and the small amount of leaves at the base of the plant was eaten to an extremely limited extent. It will be of great interest to see how this easily grown plant behaves during grazing in spring.

Canary-grass (Phalaris bulbosa and P. commutata).—These may be classed with tall oat-grass.

Red-top (Agrostis vulgaris).—At the close of the experiment this remained much as at the beginning.

Tree-lupin (Lupinus arboreus).—There was very little of this species. Beyond being nibbled slightly it was let alone.

CLASS 4. SPECIES OF NO PALATABILITY.

The following is a list of the species which apparently were not eaten at all: Hair-grass (*Aira caryophyllea*); soft brome-grass (*Bromus hordeaceus*); sterile brome-grass (*B. sterilis*); annual fescue (*Festuca myuros*); harestail-grass (*Lagurus ovatus*); desert-poa (*Poa maniototo*); nodding club-rush (*Scirpus cernuus*); the various kinds of pipiriri (*Acaena*); spaniard (*Aciphylla Colensoi*); scarlet pimpernel (*Anagallis arvensis*); alpine hard-fern (*Blechnum penna marina*); larger mouse-ear (*Cerastium triviale*); common lip-fern (*Cheilanthes Sieberi*); the three willow-herbs (*Epilobium*); white fireweed (*Erechtites quadridentata*); New Zealand bedstraw (*Galium umbrosum*); short-flowered cranesbill (*Geranium sessiliflorum* var. *glabrum*); spotted burr-clover (*Medicago maculata*); forget-me-not (*Myosotis*); yellow oxalis (*Oxalis corniculata*); hard shield-fern (*Polystichum Richardi*); the scabweed and its allies (*Raoulia*); curled dock (*Rumex crispus*); black nightshade (*Solanum nigrum*); mountain-chickweed (*Stellaria gracilentia*); mountain-nettle (*Urtica aspera*); common coprosma (*Coprosma propinqua*).

The following species, some of which field observations have proved to be more or less palatable, do not appear in my notes. They must be kept distinct from the species of the previous paragraph: Plume-grass (*Dichelachne crinita*); annual poa (*Poa annua*); hemlock-storks-bill or wild geranium (*Erodium Cicutarium*); horehound (*Marrubium vulgare*); wild-irishman (*Discaria toumatou*); *Hymenanthera dentata* var. *alpina**; gooseberry (*Ribes Grossularia*); sweetbrier (*Rosa Eglanteria*); narrow-leaved lawyer (*Rubus subpauperatus*).

* In the October number of this *Journal*, in the list of species of the Earnsclough Area, p. 188, through a printer's error, the following appears: "*Hymenanthera dentata* var. *Alpina lupinus arboreus*," with the popular name "Tree-lupin." For the sake of the general reader unversed in botanical technique it may be pointed out that there are two plants—the one, as correctly cited in the text above and which has no popular name, and the other, *Lupinus arboreus*, the tree-lupin.

INSECTS INHABITING THE GUM FLUID OF PHORMIUM.

DAVID MILLER, Entomologist, Biology Section.

LIVING in the gum fluid secreted by and collected in the leaf-bases of the native flax (*Phormium tenax*) are large numbers of insect larvæ which belong to three species of flies—*Lepidomyia decessum*, *Syrphus ropalus*, and a midge of the family *Chironomyidae*. Owing to the prevalence of these larvæ in the gum fluid of the flax suffering from "yellow-leaf" disease it was thought that they might be responsible in some way for the discoloration of the leaf. However, an examination of flax both attacked by and free from yellow-leaf shows that these larvæ are of universal occurrence, and are to be found swarming in the gum fluid of any flax-bush; further, that the gum fluid is the natural breeding habitat of these insects, which are all common native species.

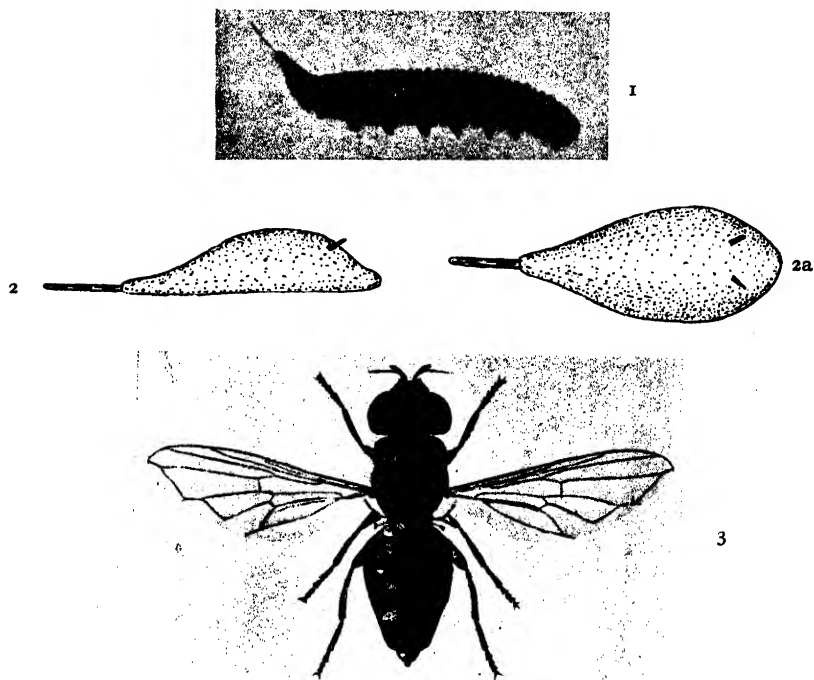
The two flies *Lepidomyia decessum* and *Syrphus ropalus* belong to the family *Syrphidae* (hover-flies), which from an economic standpoint is a most important group, the larvæ of many species being responsible for the destruction of innumerable insect pests, such as aphides and caterpillars.* The larvæ of *L. decessum* (Fig. 1), which feed upon the gum fluid, are large and conspicuous, though many very small young ones may be found at the same time. They are of the "rat-tailed" type, so called on account of the telescopic tail-like breathing-siphon which projects from the end of the body, and is thrust through the surface of the gum fluid to come into contact with the atmosphere. The young larvæ are pearly white, but the older ones are somewhat darker; on the under-side of the body are several swellings which act as means of locomotion. Apparently the larval life is of considerable length, since specimens of large larvæ were kept under observation from April to October before they pupated. Larvæ in all stages of development occur throughout the year. When the larvæ have reached their full size (about $\frac{1}{2}$ in.) they crawl out of the gum fluid on to the dead leaves of the flax-bush, and transform to pear-shaped pupæ covered by a greyish-white powder from the dried gum fluid (Fig. 2). After a time the shining blue-black adult (Fig. 3) emerges through a circular opening at the broad end of the pupæ.†

The larvæ (Fig. 4) of *Syrphus ropalus* are predaceous, and feed upon the small midge larvæ, and to a less extent the larvæ of *Lepidomyia decessum*. It is rather interesting to note that this hover-fly does not breed only in the gum fluid of flax, but the larvæ crawl over the leaves in search of the flax-grub (*Xanthorhoe praelectata*).‡ They are also found

* For a fuller account of the hover-flies in New Zealand see the writer's article "The Economic Bearing of Hover-flies," p. 129, vol. 17, of this *Journal*.

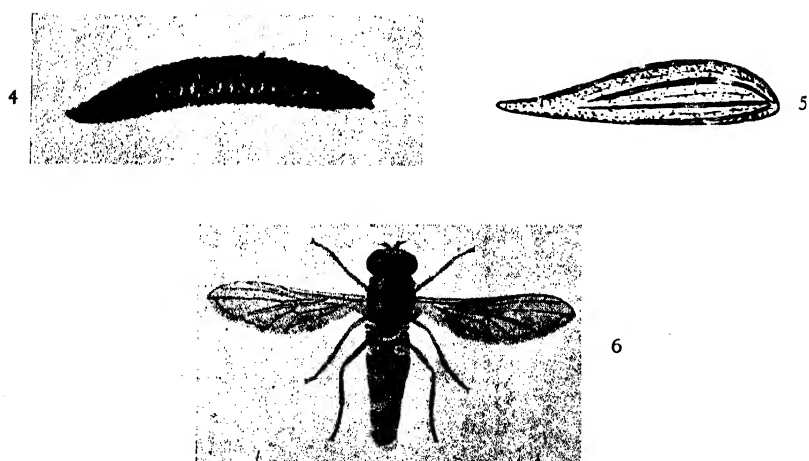
† Mr. G. V. Hudson has found the larvæ of this fly breeding in decaying matter beneath the bark of cabbage-trees (*Cordylin australis*); his specimens emerged in November, but I have observed and bred the adults from September to March and even April.

‡ See "Control of New Zealand Flax-grubs by Means of Parasites," D. Miller, this *Journal*, vol. xv, p. 303



LEPIDOMYIA DECESSUM.

Fig. 1. Larva. Fig. 2. Pupa, side view. Fig. 2a. Pupa, from above.
Fig. 3. Adult female. All $\times 4$.



SYRPHUS ROPALUS.

Fig. 4. Larva. Fig. 5. Pupa. Fig. 6. Adult male. All $\times 4$.

sheltering during the day between the leaves of cabbage-trees (*Cordyline australis*), emerging after nightfall to devour the grubs of the cabbage-tree moth (*Venusia verriculata*).* The pupæ (Fig. 5) of *S. ropalus*, when the larvæ breed in the gum fluid of flax, are to be found attached to some sheltered part of the dead leaves. They are club-shaped, and light brown in colour with darker-coloured stripes; the adult insect (Fig. 6) measures about $\frac{3}{8}$ in. in length, and is brightly coloured with orange-yellow bands and spots upon a black background.



FIG. 7. LARVA OF CHIRONOMID MIDGE. $\times 10$.

The third species breeding in the flax-gum fluid is the chironomid midge. The larvæ (Fig. 7), which occur in swarms, are small (about $\frac{1}{8}$ in. long), pearl-white in colour, and worm-like in form, swimming slowly with repeated loopings of the body. When ready to transform to pupæ the larvæ attach themselves to the leaf-butts, where they are kept continually moist. The pupæ are minute and silver-white, the legs and wings of the adult being easily seen if slightly magnified. The midge itself is minute and perfectly black, with densely plumose feelers, which give a feathery appearance to the head.

* An account of the habits of this fly upon cabbage-trees will be found in "Contributions to the Economical and Biological Study of New Zealand Entomology," by D. Miller and M. N. Watt, Trans. N.Z. Inst., vol. 47, p. 278.

[Drawings by D. Miller; photos by E. B. Levy.]

SAMPLES OF MILK FOR EXAMINATION.

It is found that samples of milk sent to the Veterinary Laboratory, Wallaceville, for examination in cases of suspected mastitis, &c., frequently arrive without any label or mark of identification on the bottles. Besides a covering letter, the bottle or package should always be marked in such a way that it may be readily identified, and the result of the examination communicated to the sender with certainty.

"*Silver-fish*."—These insects, when infesting houses, may be trapped and destroyed by covering pieces of cardboard with paste made of flour to which some white arsenic has been added. Another method is to fumigate the infested room with sulphur.

TESTING OF PUREBRED DAIRY COWS.

C.O.R. LIST TO END OF NOVEMBER.

W. M. SINGLETON, Assistant Director of the Dairy Division.

THE list of certificates issued during November is comparatively strong for some classes, although other classes show no records of exceptional merit. The mature Jerseys are again very much in evidence with quite a number of praiseworthy records. The Friesians have added another name to the 800 lb. class, and the Ayrshires have a new leader of the two-year-olds. The Milking Shorthorns are very creditably represented in the mature class, and show a good record in the junior four-year-olds. Owing to pedigrees of these particular animals not being available in the Herd-book no comment on their breeding can be made.

JERSEYS.

The records printed in the appended list show that Messrs. O'Sullivan and Sons are again to the fore with animals in the junior two-year-old and three-year-old classes respectively. Meadowvale Ovation and Meadowvale Desire are daughters of Sunflower's Perseus from different dams. Meadowvale Desire is from Oaklea's Maid, a daughter of Dalesman Jack from a daughter of K.C.B. Oaklea's Maid as a two-year-old produced a credit of 375.73 lb. butterfat. Just what percentage of the daughter's superiority over her dam is due to the influence of Sunflower's Perseus we are unable to state.

The four-year-old Jerseys contain two good records in those for Salamoniam and Poi. Mr. Hazelton, of Waihou, the owner of Salamoniam, has done good work for Jerseys in the Thames Valley. Salamoniam is a granddaughter, through her sire, of Campanile's Sultan, her sire being a half-brother to Sultan's Daisy. Salamoniam's dam traces to K.C.B. and at least four times to the Primrose strain.

Poi, owned and tested by Mr. F. S. McRae, belongs to a well-known strain. Her dam is Mere, who held the world's championship with a record for heifers commencing test under two years of age. Mere is a granddaughter of Charm, with a 572-lb.-butterfat record as a four-year-old. Readers will recollect that Mere is a daughter of Fancy's Lord Twylish, a sire with fourteen C.O.R. daughters, three of which exceeded 600 lb. butterfat. The sire of Poi is Buttercup's Titan, by Titan from a daughter of Retford Boy. Titan is full brother to Titanite, who has a C.O.R. for 513.88 lb. butterfat. This second record of Poi's raises her previous record in the junior two-year-old class by almost 90 lb. fat.

To the mature class are credited five records of more than 600 lb. butterfat, and seven others of more than 500 lb. Lambert's Countess, owned by Mr. J. Hale, holds pride of place with one of only two records exceeding the 650 lb. mark. She is sired by a son of Campanile's Sultan, and is from Countess of St. Lambert. Majesty's Neathead, tested by Mr. S. R. Lancaster, also exceeded the 650 lb. production. She is sired by Majesty's Fox, who now has twenty-seven C.O.R. daughters. The dam of Majesty's Neathead is Neathead, with a C.O.R. in the

three-year-old class for 565.75 lb. fat. As a show-ring cow Neathead combined beauty and production to a degree much above the average.

FRIESIANS.

Numerically the black-and-whites do not constitute a strong representation this month. Their average production, however, is high. Four of the five trace exclusively to North American strains. The sire and dam of Heilo Johanna Lyons were imported from the United States. Her sire is Mutual Piebe of Rock, who has now eight C.O.R. daughters. Mutual Piebe of Rock is by Mutual Piebe de Kol, well known as the sire of Mutual Pearl of Rock, Dominion Mutual Mercedes of Rock, and other C.O.R. cows.

Mr. Vernon Marx, of Mangatoki, has not appeared in C.O.R. lists hitherto, but he has certainly permitted Alcartra Clothilde Pietje



ALCARTRA CLOTHILDE PIETJE.

(here depicted) to make an enviable record. This record is all the more creditable in that shortly after this cow commenced her test she developed udder trouble, and produced the major portion of her season's yield while milking from three quarters only. She traces entirely to strains imported by Mr. Newton King. Her sire and dam are each sired by King Alcartra Pietje, whose pedigree includes such animals as Pietje XXII, Hengerveld de Kol, and Alcartra Polkadot. Sir de Kol Inka Pietertje, who also figures twice in the pedigree, has some fourteen C.O.R. daughters, including Lady Rozine, with a C.O.R. for 510.93 lb. butterfat.

Messrs. H. North and Sons have two representatives in this list. The first is Burkeyje Beets Posch, a Canadian-bred half-sister of Burkeyje Sylvia Posch, New Zealand's highest record cow at present. These two females have in common some 87 per cent. of their ancestry,

as indicated by their pedigrees. It was therefore to be expected that Burkeyje Beets Posch would produce well. Holland Lassie, owned and tested by the same breeders, is a daughter of the well-known Cliffside Laddie, who now has eighteen C.O.R. daughters, a number of which have produced very attractive records. The dam of Holland Lassie is by King Manor de Kol and from a cow by Dutchman. She therefore receives three-fourths of her inheritance from strains imported from North America.

AYRSHIRES.

We are pleased to report the records of three Ayrshires. Greenfield's Sprightly II, owned and tested by Mr. C. E. C. Webb, of Koputaroa, has annexed a very creditable record in the senior two-year-old class. She becomes the leader of her class, displacing Kanadale Linda, who has a C.O.R. for 502.55 lb. butterfat. This new class-leader makes a good addition to the Ayrshire records, and her performance should prove an encouragement to other young Ayrshire breeders. The dam of Greenfield's Sprightly II is from Dark Stately of Greenfields, C.O.R. 354.29 lb. butterfat in 344 days as a four-year-old. This cow is by Brown Jock, who sired Bonnie Stately, C.O.R. 357.15 lb. fat in 311 days. The sire of Sprightly II's dam is a son of Prince John of Inglewood, and is therefore half-brother to Daisy II of Hagbourne, who in 325 days produced a C.O.R. credit of 467.12 lb. fat. As these milking-periods are all for less than a year the days in milk include to a considerable extent the period of drying off. Due allowance should be made in this respect. We congratulate Mr. Webb on his success with his favourite breed.

LIST OF RECORDS COMPLETED IN NOVEMBER, 1920.

Name of Cow and Class.	Tested by	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS.						
<i>Junior Two-year-old.</i>		Yrs.dys.	lb		lb.	lb.
Meadowvale Ovation	E. O'Sullivan and Sons, Tariki	2 16	242.1	361	8,139.5	486.55
Lady's Sweet ..	A. J. Harris, Bombay	2 28	243.3	361	7,590.1	461.07
Viola's Golden Mercedes	E. Griffiths, New Plymouth	2 11	241.6	365	6,556.5	440.12
Heroine's Pride ..	H. J. Berry, Kaupokonui	1 318	240.5	354	7,053.6	415.91
Briar Chase ..	W. J. Hall, Matatoki	2 79	248.8	332	6,869.6	371.49
Beauty's Sunbeam ..	F. E. Day, Tamahere	2 34	243.9	365	7,496.4	363.21
Snow View's Maid ..	D. P. F. Malone, Kauponga	1 338	240.5	334	5,770.2	356.70
Maria Louisa ..	F. J. B. Ryburn, Paterangi	1 341	240.5	365	7,080.4	352.17
Sunshower ..	F. J. B. Ryburn, Paterangi	2 56	246.1	331	6,196.7	350.80
Beaumont's Miss Champ	R. Prentice, Kiwitea	2 48	245.3	329	6,552.5	337.29
Success of Bull's ..	F. J. Watson, Bull's	2 65	247.0	357	5,743.3	297.06
Lady Bilberry ..	E. Griffiths, New Plymouth	2 52	245.7	323	5,639.0	294.65
Belvedere Bilberry's Last	E. Griffiths, New Plymouth	1 314	240.5	307	5,598.5	283.60

LIST OF RECORDS—continued.

Name of Cow and Class.	Tested by	Age at starting Test.	Fat reqd. for Cart.	Yield for Season.		
				Days.	Milk.	Fat.

JERSEYS—continued.

<i>Senior Two-year-old.</i>		<i>Yrs. dys.</i>	<i>lb.</i>		<i>lb.</i>	<i>lb.</i>
Beachland's Marigold	F. J. B. Ryburn, Paterangi	2 323	272·8	365	7,924·0	447·98
Madam Matilda ..	A. Hazelton, Waihou	2 296	270·1	365	7,080·8	404·23
Hollybank Buttercup	E. Griffiths, New Plymouth	2 313	271·8	319	7,622·9	401·47
Waratah Tinsel ..	Mrs. M. A. Rogers, Kaitiaki	2 355	276·0	365	7,272·3	390·30
<i>Three-year-old.</i>						
Meadowvale Desire	E. O'Sullivan and Sons, Tariki	3 7	277·7	365	9,411·3	570·31
Tiny Kura ..	C. H. Weston, New Plymouth	3 15	278·5	365	7,189·0	444·18
Mountain View's Clematis	E. Griffiths, New Plymouth	3 336	310·6	365	8,188·2	442·13
Lady Winnie ..	E. Griffiths, New Plymouth	3 356	312·6	365	6,440·1	412·79
Heather Flower ..	J. Linn, Normanby ..	3 351	312·1	262	6,624·6	405·63
Waipuku Princess ..	A. Hazelton, Waihou	3 37	280·7	365	7,372·7	394·29
Heather Lady ..	A. L. Hooper, Mahoe	3 353	312·3	328	6,362·7	353·80
<i>Four-year-old.</i>						
Salamonia ..	A. Hazelton, Waihou	4 358	349·3	365	9,531·2	537·99
Poi ..	F. S. McRae, Palmerston North	4 82	321·7	340	9,942·1	528·85
Roslyn Juno Light ..	J. Harris, Bombay ..	4 345	348·0	365	8,759·4	493·56
Mystery Lass ..	E. Griffiths, New Plymouth	4 24	315·9	323	6,886·1	403·57
<i>Mature.</i>						
Lambert Countess ..	J. Hale, New Plymouth	6 187	350·0	365	10,022·0	657·40
Majesty's Neathead	S. R. Lancaster, Palmerston North	6 320	350·0	365	10,667·75	650·54
Jersey Bank Pretty	J. Hale, New Plymouth	8 342	350·0	365	10,817·5	611·86
Rainbow's Gleam ..	A. & J. O'Donnell, Inahā	6 321	350·0	365	11,094·1	608·73
Eminent's Caif ..	J. W. Bradey, Te Horo	8 305	350·0	365	10,293·5	605·30
Kathleen Twylish ..	F. E. Day, Tamahere	7 307	350·0	365	9,960·8	591·04
Rioter's Merry ..	J. Hale, New Plymouth	6 10	350·0	365	10,409·5	586·63
Rose Royal ..	J. Hale, New Plymouth	7 81	350·0	362	10,977·0	548·07
Miro Meadows Rata	C. A. Care, Cambridge	6 222	350·0	365	9,285·3	531·29
Olga's Buttermilk Chase	W. J. Hall, Matatoki	7 10	350·0	343	8,790·5	515·54
Fair Maid of Inahā	A. & J. O'Donnell, Inahā	6 352	350·0	365	9,961·9	503·25
Miss Neathead ..	S. R. Lancaster, Palmerston North	6 267	350·0	356	7,269·7	500·85
Wairoa ..	H. J. Berry, Kaupokonui	9 252	350·0	356	7,742·2	467·53
Roslyn Juno Girl ..	J. Harris, Bombay	5 88	350·0	287	8,448·8	466·22
Hazelina ..	W. J. Hall, Matatoki	10 158	350·0	365	7,731·8	434·16
Little Sultan's Mary	Murray Bros., Wharehuia	7 189	350·0	317	6,484·0	422·54
Queen Elizabeth ..	E. L. Roose, Pukekohe	5 30	350·0	365	8,047·8	411·79
Elvira ..	J. R. Jones, Tariki ..	5 2	350·0	360	5,518·3	350·72

FRIESIANS.

<i>Junior Two-year-old.</i>						
Salma Hope De Kol	W. Barton, Featherston	2 124	262·9	365	12,312·4	428·29
<i>Senior Three-year-old.</i>						
Heilo Johanna Lyons	W. Barton, Featherston	3 299	306·9	365	14,896·7	520·60

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at starting Test.	Rated by C.A.T.	Yield for Season.		
				Days.	Milk.	Fat.

FRIESIANS— <i>continued.</i>						
<i>Mature.</i>		Yrs.	dys.	lb.	lb.	lb.
Alcatra Clothilde Pietje	V. Marx, Mangatoki..	5	319	350·0	365 23,011·0	842·71
Burkeyje Beets Posch	H. North and Sons, Omimi	7	123	350·c	365 17,461·0	613·63
Holland Lassie ..	H. North and Sons, Omimi	7	272	350·c	365 16,172·1	576·47

MILKING SHORTHORNS.						
<i>Senior Two-year-old.</i>						
Cloverlea Fairy I ..	D. Buick, Palmerston North	2	350	275·5	339 9,497·2	378·91
<i>Junior Three-year-old.</i>						
Matangi Nancy ..	Ranstead Bros., Matangi	3	9	277·9	365 10,795·4	399·63
Rushmere Granny I	W. H. Brewster, Feilding	3	43	281·3	365 8,938·9	345·40
<i>Junior Four-year-old.</i>						
Matangi Jewel ..	Ranstead Bros., Matangi	4	6	314·1	365 12,524·4	509·45
<i>Senior Four-year-old.</i>						
Matangi Sunshine ..	Ranstead Bros., Matangi	4	345	348·c	365 12,057·0	427·59
<i>Mature.</i>						
Newstead Bella ..	S. Lye, Newstead, Hamilton	..		350·0	365 15,274·0	594·62
Newstead Pet ..	S. Lye, Newstead, Hamilton	..		350·0	365 14,345·2	551·50
Willowbank Sunbeam	S. G. Morgan, Ngawapuru	13	0	350·0	365 12,568·6	535·35
Lowlands Beauty ..	C. Hearsey, Longburn	..		350·0	365 12,712·9	517·17
Newstead Polly ..	S. Lye, Newstead, Hamilton	..		350·0	365 13,162·6	506·80
Hamilton Mary ..	S. Lye, Newstead, Hamilton	..		350·0	364 13,102·7	500·14
Matangi Anne ..	Ranstead Bros., Matangi	..		350·0	330 12,096·0	483·81
Matangi Molly ..	Ranstead Brs., Matangi	7	340	350·0	292 12,776·0	463·93
Newstead Jenny ..	S. Lye, Newstead, Hamilton	..		350·0	357 10,645·8	452·75
Newstead Nellie ..	S. Lye, Newstead, Hamilton	..		350·0	341 10,921·7	448·83
Garnet of Cornwall Park	R. V. Brown, Weraroa	12	31	350·0	320 11,384·7	419·59
Newstead Pansy ..	S. Lye, Newstead, Hamilton	..		350·0	365 9,958·8	398·82

AYRSHIRDS.						
<i>Two-year-old.</i>						
Greenfield's Sprightly II	C. E. C. Webb, Koputaroa	2	335	274·0	365 13,598·6	507·87
<i>Three-year-old.</i>						
Dominion Ruby II ..	A. Montgomerie, Kawhata	3	357	312·7	358 8,877·6	373·12
Beauty I of Porirua	A. Montgomerie, Kawhata	3	304	307·4	323 9,000·4	347·50

LEGISLATION OF 1920 AFFECTING RURAL INTERESTS.

T. D. H. HALL, Head Office, Department of Agriculture.

THE session of 1920 was not marked by any outstanding agricultural legislation, but the following summary sets out provisions which are of interest to the farming community :—

RABBIT NUISANCE AMENDMENT ACT.

Part II of the Rabbit Nuisance Act, 1908, deals with the constitution of rabbit districts on the petition of the majority of stockowners therein. The qualification of a "stockowner" for this purpose is the ownership of 500 sheep or 100 head of cattle (one head of cattle is reckoned as five head of sheep), and these stockowners are the sole voters and ratepayers in any constituted district. Closer settlement and dairying have necessitated a change, and the stockowner's qualification is fixed by the Amendment Act at 100 sheep or 20 head of cattle.

Rabbit districts may also be constituted at the instance of ratepayers. The principal Act provides that in such districts the rate leviable for rabbit-destruction purposes shall be leviable on the rateable value of the land in the district. In certain classes of country this militates against the successful establishment or working of a district. Provision is therefore made for an alternative system of rating on an acreage basis. The rating-system to be adopted is to be determined by a poll.

Power is conferred on Rabbit Boards to borrow by way of overdraft on the security of the revenue receivable by them.

The Rabbit Nuisance Amendment Act, 1918, gave extended powers to Rabbit Boards, constituted under Part III of the principal Act, in the matter of the erection of rabbit-proof fencing. The rights and liabilities of the Boards as owners of the fences are now laid down by incorporating similar provisions to those already existing in the case of rabbit-proof-fencing districts.

The Governor-General in Council may authorize Rabbit Boards in districts constituted under Part II of the Rabbit Nuisance Act (stockowners) to take the necessary steps for destroying rabbits on land without first serving notice on the owners of the land.

Power is given to make regulations prescribing the means to be adopted for destroying rabbits, regulating trapping, regulating purchase and sale of rabbits and skins, and regulating the export of rabbits and skins.

ORCHARD AND GARDEN DISEASES AMENDMENT ACT.

This amendment provides power to regulate the sale of fruit affected with black-spot.

APIARIES AMENDMENT ACT.

Power is given in this amendment to provide for a registration fee for apiaries. The revenue is to be devoted to the furtherance of the industry.

AGRICULTURAL AND PASTORAL SOCIETIES AMENDMENT ACT.

Before a society incorporated under the Agricultural and Pastoral Societies Act can sell or exchange any land derived by it from the Crown the precedent consent of the Governor-General in Council is now necessary.

COMPANIES AMENDMENT ACT.

When a company formed for a particular purpose desires to engage in operations not provided for in its memorandum or articles of association, a special procedure is necessary to amend the memorandum or articles. Relief is provided now in the case of companies formed wholly or in part for the manufacture of butter or cheese. Such companies may, without alteration in the memorandum or articles of association, engage in the manufacture of rennet, casein, sugar of milk, butter-boxes, cheese-crates, and other articles subsidiary to their main purpose, or may acquire shares in any company carrying out such manufactures, or formed to undertake the export and marketing of dairy-produce, or to erect and carry on cool stores and freezing-works.

LAND AND INCOME TAX AMENDMENT ACT.

The exemption from income-tax enjoyed by co-operative butter and cheese factories has been removed, but it is provided that in calculating the amount of income of such a factory there shall be deducted from the total receipts of the factories the amounts paid to suppliers in so far as such amounts are apportioned on the basis of the milk (or cream) supplied.

COUNTIES ACT.

County Councils are now given powers to erect cattle-dips, and to make by-laws and fix fees for their use.

County Councils are also empowered to purchase and sell rabbit-proof wire netting on suitable terms.

HEALTH ACT.

A local authority is empowered to make by-laws defining areas in its district within which it shall be unlawful to establish or maintain stables, cow-sheds, or piggeries. The Board of Health may direct such areas to be defined.

No cattle-saleyard may be established without the consent of the local authority and the Medical Officer of Health. Provision is made for the registration of cattle-saleyards, and no premises must be used as cattle-saleyards unless registered.

Board of Agriculture.—Mr. James Begg, of Dunedin, has been appointed a member of the Board of Agriculture (Otago District), to fill the vacancy caused by the death of Mr. A. S. Orbell.

THE USE OF NAURU ISLAND PHOSPHATE.

EFFICACY OF THE FINELY GROUND RAW MATERIAL.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

It is not yet sufficiently realized by the farming community that the high-grade phosphates obtained from the Pacific islands have been for a number of years used on New Zealand soils without having been first converted into superphosphate. The only treatment to which the greater quantity of imported rock has been subjected before application to the soil is the purely mechanical process of drying, grinding to a powder, and diluting with other material. The use of ground phosphate rock by itself has passed beyond the experimental stage, as may be proved by the numerous field trials conducted with root crops at the Moumahaki Experimental Farm in past years, from 1904 onwards, and at the Mamaku Experimental Farm and the Wallaceville Laboratory Farm on pasture. It is true that for some classes of crops, notably those of the turnip family, an admixture of superphosphate with the phosphate rock, or even superphosphate by itself, may yield the highest results, as superphosphate contains a considerable quantity of a sulphur compound in the form of sulphate of lime, and compounds of sulphur are supposed to be beneficial to the turnip family, whereas phosphate rock contains no sulphur compounds. Further, applied in moderate amounts superphosphate is a powerful stimulant to the growth of root, hence to farm plants with an inferior rooting-system superphosphate affords a quick and efficient means of conveying an extremely soluble food to the young growing plant-roots.

It is a truism that unlike things cannot be compared. Superphosphate and phosphate rock are alike in that they supply phosphate to the land, but they are unlike in that each acts in a different manner, and therefore each is adapted for use in a different set of conditions. The phosphate in superphosphate is soluble in water, so that after being applied to the soil the phosphate is dissolved in the first rain, but it is quickly rendered insoluble in contact with the soil-particles, and is thus brought into intimate contact with the root-hairs and so absorbed. The phosphate in phosphate rock is insoluble in water, and therefore for bringing it into proximity with the root one must rely on the fineness of grinding. But even at this stage the conditions are not comparable. The phosphate of super after having become insoluble in pure water is still in a condition which is more soluble in the soil water—the latter containing the powerful solvent carbonic acid—than is the phosphate of phosphate rock. However, in a moist soil in a district of well-distributed rainfall this difference in solubility is not likely to result in so great a disparity of crop-yield as to affect the value of finely ground phosphate rock compared with superphosphate, and it must be remembered that there is more than twice as much phosphorus in the rock as in the super made from it. It is in dry, semi-arid and arid climates, where the

rainfall is ill-distributed and scanty, that superphosphate is so superior to phosphate rock. In districts like Southland, where the rainfall is well distributed and ample, guano (which is another somewhat euphemistic name for ground phosphate rock) is used in preference to superphosphate.

Too great stress cannot be laid on the fact that *bona fide* differences in the opinion of observers as to the relative efficacy of rock phosphate compared with superphosphate arise from differences in the soils and climates whence their experiences were derived. An Australian's experience is thus likely to differ largely from that of a New-Zealander. Similarly, experience derived from the arid portions of Central Otago or Marlborough is likely to provide a different judgment than that afforded by results derived from Southland, Taranaki, or Westland.

About 40,000 tons of phosphate rock were imported into New Zealand last year, only a comparatively small proportion of which could have been made into superphosphate, judging by the amount of sulphur imported into or mined in New Zealand. It is estimated that about 30,000 tons of this ground phosphate rock was used without any chemical treatment—that is to say, the only treatment used to convert the rock into a marketable phosphate was one of grinding and dilution with other materials. It is to be hoped that when Nauru phosphate arrives the amount of grinding it receives will be intensified in order to make a finer, more available product, and that the practice of dilution with sand and limestone may be abolished altogether. Where the farmer requires lime or limestone it is economically preferable to purchase it separately.

It is certainly incorrect to say that the phosphate rock when finely ground is unavailable for plants because it is insoluble in pure water, for the water in the soil is not pure water, but contains carbonic and other acids which are powerful agents in rendering mineral food available for the plant. It is also incorrect to say that phosphates are extensively leached out of the soil by the drainage-waters. The fate of the phosphates in the soil is one which is continually progressing towards a condition of greater insolubility. When the most soluble form of phosphate—super—is used the great proportion never percolates into the soil more than a few inches further by drainage, and therefore is comparatively stable in position until removed by crops or stock. To prevent a phosphate from becoming too insoluble, and therefore too unavailable for plants, it is advisable to lime freely and to keep the organic matter—the so-called humus—present in good quantities.

NOTES.—The Department's Bulletin No. 54 (New Series), "Rock Phosphate in New Zealand," obtainable free on application, gives details of the good results obtained from rock phosphate with crops. Articles on "The Improvement of Poor Pasture," in the *Journal* for January, 1919, and October, 1920, show the effect of top-dressing pasture with ground rock phosphate compared with other fertilizers.

Those who desire to study the matter further should consult the chapter "Use of Phosphorus in different Forms," in Hopkins's "Soil Fertility and Permanent Agriculture" (Ginn and Co., London, 1910); also Sir A. D. Hall's "Fertilizers and Manures," 1909, in which, on page 118, it is stated there is plenty of evidence that when mineral phosphates are really finely ground they are effective enough on soils retaining plenty of water. See also the recent statements of British authorities quoted on page 194 of the October number of this *Journal*.

THE LATE SIR DAVID HUTCHINS.

By the death last month of Sir David Hutchins, the distinguished scientific forester, the *Journal* has lost an esteemed contributor. The first wide publicity given to Sir David's views on the forestry position in the Dominion was in our issues of October and November, 1916, when his address at the inaugural meeting of the Forestry League was published in revised form under the title of "Scientific National Forestry for New Zealand." This was subsequently reprinted by the League as a pamphlet. To the *Journal* for March, 1918, Sir David contributed an article on "The Waipoua Kauri Forest : Its Demarcation and Future



SIR DAVID HUTCHINS (ON RIGHT) AND MR. J. TROUNSON IN KAURI BUSH,
NEAR KAIHU.

Management," a forerunner of his official report on the same subject. Several shorter notes by him on forestry subjects were also published at various dates.

It is unnecessary to here give biographical details of Sir David Hutchins's career and the circumstances of his coming to New Zealand, these having appeared elsewhere. A fitting public tribute to Sir David's work has also been paid by the president of the Forestry League, Sir James Wilson, to whom perhaps more than any other person Sir David's fortunate advent to this country was due. Suffice it to remark that at a critical stage for the future existence of the New Zealand native forests Sir David's forcible exposition and advocacy of demarcation and reservation combined with the production of a continuous yield of timber by natural regeneration and other improvement (in place

of destructive milling, which had come to be generally regarded as inevitable), was a leading factor towards saving the situation. It may also be fairly claimed that to his influence was mainly due the recent formation of a Dominion Department of Forestry, scientifically directed, and with the real foundation-work well in hand. Sir David's special work for the Dominion was thus really accomplished when he passed away.

Part I of a comprehensive report by Sir David Hutchins to the Government on "New Zealand Forestry," dealing with the kauri forests and forests of the North and forest management, was issued early in the present year. Sir David was very desirous that this treatise should have a good distribution among the farming community, being always keen to keep his gospel of forest reform before the leading rural interest. The publication, an illustrated volume of 200 pages, may be obtained by remitting 2s. 6d. to the Secretary, Forestry Department, Wellington.

WAIMATE WEST DEMONSTRATION AREA.

OPERATIONS FOR YEAR 1919-20.

J. W. DEEM, Fields Instructor, and Supervisor of Subsidized Demonstration Farms.

THE Waimate West Demonstration Area is now fairly under way. From a financial point of view the first complete year has proved satisfactory, the working account showing a credit balance of £188 10s. 4d. The initial work outlined in the December, 1919, *Journal* has been continued. The manager's house has been completed, and a two-roomed cottage is in course of erection. This will be used as an office, and will provide sleeping-accommodation for extra labour on the farm.

THE DAIRY HERD.

The results from the herd must be considered satisfactory. According to the testing association's figures the herd of thirty-one cows and sixteen heifers averaged 279·67 lb. butterfat per head for an average milking-period of 242 days, the cows averaging 296½ lb. and the heifers 252 lb. These figures work out at approximately 13,144 lb. butterfat for the season, whereas the actual amount credited at the factory was 13,019 lb., a difference of 125 lb. in favour of the association's figures. Against this 125 lb. has to be credited the fresh milk used for calves and the house. These points are mentioned to show that the results from the ordinary testing association are accurate enough for all practical purposes if properly carried out.

To emphasize the necessity of testing, it may be mentioned that the best cow gave 404 lb. and the poorest 216 lb. butterfat, while the best heifer gave 350 lb. and the poorest 178 lb.

Fourteen heifer calves were reared. Seven of these have been sold to the Stratford Model Dairy Farm Society, and seven are being retained to build up the herd.

THE CROPS.

The crops on the whole were good. A great many varieties of roots, kales, &c., were tested.

Roots.—In the main varieties the best results were yielded in the following order :—

Mangolds: White Sugar, 60 tons 1 cwt.; Jersey Queen, 53 tons 18 cwt.; Prizewinner, 52 tons 13 cwt.; Long Red, 50 tons 1 cwt., per acre.

Swedes: Grandmaster, 31 tons 6 cwt.; Superlative, 30 tons 17 cwt.; Best-of-All, 30 tons 7 cwt.; and Magnum Bonum, 29 tons 15 cwt., per acre. The swede-ground was very foul with weeds—fumitory and wild turnip—and it was found necessary to grow the crop in 28 in. drills, and give intercultivation. In a test for dry-rot Superlative was badly affected.

Soft turnips: Imperial Green Globe, 45 tons 17 cwt.; Purple-top Mammoth, 44 tons 15 cwt.; Lincolnshire Red Globe, 43 tons 5 cwt.; and Hardy Green Globe, 41 tons 6 cwt., per acre. Sown on the same day they were ready to feed in the following order: Purple-top Mammoth, Lincolnshire Red Globe, Imperial and Hardy Green Globe equal.

Carrots: Matchless White, 47 tons 16 cwt.; Magnum Bonum, 38 tons 10 cwt.; Sinclair's Champion, 34 tons 14 cwt., per acre.

Millets and Sudan Grass.—Six varieties of millets and one of Sudan grass were sown at the end of November, and, being very weedy, were cut on 19th January, at which time they were about 1 ft. high. They were cut again on 3rd March, and gave the following weighings per acre: Sudan grass, 13 tons 10 cwt.; Japanese millet, 12 tons; Hungarian millet, 11 tons 5 cwt.; Proso, 11 tons 1 cwt.; Manchurian, 10 tons 18 cwt.; Chinese, 7 tons 14 cwt.; Pearl, 5 tons 2 cwt. None of the millets made any further growth of value, but the Sudan grass came away rapidly and furnished a further cutting of between 4 and 5 tons per acre.

Lucerne.—It was found on breaking up the land that the whole of the farm was badly infested with weeds—wild turnip and fumitory being especially bad. This has delayed lucerne-sowing, but it is hoped to get an area down in the current December.

Manurial Tests.—With swedes, super and slag, equal parts; basic super; and super, bone, and slag, equal parts, gave the best results. In the mangold trials the addition of 3 cwt. of salt increased the yield by between 2 and 3 tons per acre. It was found in the trials that where bone-meal or blood-and-bone were the predominating manure the fly was very bad, many of the rows being cleaned right out, while adjoining rows with a mineral phosphatic manure were not touched.

PASTURE TOP-DRESSING.

Sixty acres of the farm have now been top-dressed. It is too soon to record any definite results, although so far basic super seems to be doing as well as anything. One test, however, has already furnished interesting matter. In August, 1919, a 12-acre paddock was treated.

One half received 3 cwt. basic super per acre, the other half 6 cwt. carbonate of lime and 2 cwt. superphosphate per acre. In subsequent stocking last season the cows kept the basic super end closely fed down, and allowed the lime super end to get rank. During last winter the whole field was cleaned up, and this spring it has been more evenly fed down; at the same time the manager reports that the cows always eat the basic super end of the paddock first.

MANAGEMENT, ETC.

The committee whose personnel was given in last year's notes (*Journal*, December, 1919) and Mr. Dakers, the manager, are still in office, and all have pulled together to make the farm a success. The interest created has been evinced by the large number of visitors, including several branches of the Farmers' Union.

WORK FOR THE COMING MONTH.

THE ORCHARD.

THE present two leading matters of interest among fruitgrowers, apart from ordinary routine work, are export and fire-blight. Whether considered separately or jointly, both these factors are calculated to have a very important bearing on the future of the fruit industry, and, although widely different from one point of view, if the worst should happen in either case the result will be very much the same.

Every one in the industry is aware that the local market must be relieved by some means, and, although there are different methods which, when jointly operating, may result satisfactorily, export suggests itself as being the most effective and simple means of attaining immediate and lasting results. Should failure, through any fault on the part of the grower, shipping companies, or markets, attend this phase of the industry, fruitgrowing in New Zealand is bound to receive a very definite set-back. Likewise, should fire-blight become generally spread throughout the fruitgrowing areas of the Dominion the effect on the industry would be quite as disastrous as the failure of export.

Fire-blight is firmly established in several large areas in the Auckland Province, but, fortunately, these areas in the main are of little importance from the viewpoint of existing commercial fruit-production. Whether the disease will spread to more important districts time alone will tell, and in the meantime the Department's officers are doing all that is within their power to lessen this danger. The Director-General of the Department, together with Messrs. T. W. Kirk and A. H. Cockayne, recently visited the affected areas for the purpose of studying the position first-hand with a view to formulating more effective statutory measures on the matter.

Adverting to export, the position is apparently well in hand to date. Preliminary bookings total well over 200,000 cases. Several districts are contributing, but the great bulk is coming from Nelson. Although there is still a lot of work to be done, the organization for assembling and handling the fruit in an efficient manner has been very much improved as compared with last year.

Although the possibility of failure with reference to both export and fire-blight has been referred to in this note, failure in either case is not necessarily anticipated. On the contrary, the object of such reference is more to impress the grower with the fact that all is not plain sailing, and that he, together with the Department, has a definite responsibility in both instances and must work in close co-operation, in order that success, not failure, may be the result.

—J. A. Campbell, Assistant Director of the Horticulture Division.

AUCKLAND.

Weather conditions generally experienced during January being often conducive to the increase of fungoid diseases and insect pests, no relaxation in spraying operations should take place. The following are the most important:—Peach, nectarine, and plum: Commercial lime-sulphur, 1-125, or self-boiled lime-sulphur, 8-8-50, when the fruit begins to ripen, and further as circumstances demand. In cases where the black aphid of the peach is giving trouble McDougall's Insecticide, 1-50, should be used. A second application may also be necessary to effectually control this insect. Pear, apple, and quince: Commercial lime-sulphur, 33° test, 1-100, in conjunction with arsenate of lead, paste 1½ lb. or powder ¼ lb. to 50 gallons every twenty-one days. Lemon and orange: Bordeaux, 4-4-40, when petals have fallen from the main-crop blossoms (if not already applied). The commercial lime-sulphur application should be continued wherever black-spot is showing.

Cultivation should receive full attention throughout the month, especially if droughty conditions set in. —J. W. Collard, *Orchard Instructor, Auckland.*

HAWKE'S BAY.

Crops on the average are light this season in this district, so the various varieties will need harvesting very carefully to secure the maximum returns. Early varieties of stone-fruits and apples will now claim attention. Peaches should be gathered while still firm, though of full size and well coloured. Make several pickings (selections) from the same trees, and pack separately all fruits inclined to a soft ripe condition. While there may be little or no brown-rot showing in the orchard, there is every chance that this trouble may develop under the congested conditions of a case pack. Endeavour to have the trees sprayed with lime-sulphur, 1-120, a week or so before picking; handle the fruit carefully; and, above all, do not pack skin-punctured fruits.

Though there will be plenty of other work on hand, make an effort to maintain a clean cultivation, with the surface soil well worked.

Spraying for the month will consist mainly of regular applications of arsenate of lead to apple, pear, quince, and plum, for codlin-moth, leech, and leaf-roller; lime-sulphur, 1-120, on stone-fruits, for rust and brown-rot; lime-sulphur, 1-100, on apples and pears, for red mite, powdery mildew, and black-spot; and Blackleaf 40 on apples affected with woolly aphid.

When preparing fruit for market the orchardist should remember to brand his cases with his registered number.

—W. H. Rice, *Orchard Instructor, Hastings.*

NELSON.

Orchard summer spraying depends very much on the kinds and variety of fruit grown—on its susceptibility to aphid, spot, red mite, &c., and on the danger of burning or russetting the fruit. During these warmer months it is usual to further dilute the lime-sulphur spray to 1-120 for pip-fruit and 1-125 for stone-fruit. Brown-rot is often troublesome now, and the precautions recommended in last month's notes should be carefully observed. It should be remembered that bordeaux mixture and Blackleaf 40 when mixed together are dangerous to orchard foliage, the ingredients being incompatible.

While it is most undesirable to work the land too soon after rain or when it is the least bit sticky, if the weather be dry good cultivation should be maintained throughout January.

The stone-fruit harvest is now at its height. Greater care is needed in picking and packing these goods. Quite a different sample is required for local shops and factories as compared with Wellington and more distant markets. Too often these samples are somewhat mixed.

Towards the end of January it is customary to perform the operation of summer pruning where necessary. Its object is to check overrank growth and bring it into bearing. It is specially useful in the case of some varieties of pears.

The operation of budding can now be advantageously carried out.

—W. C. Hyde, *Orchard Instructor, Nelson.*

CANTERBURY.

Insect pests and fungus diseases of pip-fruits: Provided the sprayings recommended during the earlier months of the season have been carefully and thoroughly carried out at the given periods, very little trouble, if any, should be experienced from diseases. For codlin-moth, leaf-roller, and pear-slug spray again as directed

in last month's notes. In orchards where woolly aphis, red mite, or leaf-hopper are in evidence spray at regular intervals with either Blackleaf 40, 1 in 1,000, or with lime-sulphur, 1 in 120. Control powdery mildew as directed in last month's notes.

Insect pests and fungus diseases of stone-fruits: In orchards where black aphis, cherry-slug, red mite, brown-rot, and bladder-plum are present spray as directed last month.

Suckering: Remove all suckers from trees—an important work too often neglected.

Cultivation: Keep the soil well stirred, so as to conserve the soil-moisture during this critical period in fruit-development. Trees carrying heavy crops of fruit will require a considerable quantity of moisture to mature successfully the crops they are at present carrying. Cultivation will keep the weeds down.

Marketing: Another fruit season has begun. Canterbury growers will find it to their advantage to study last month's notes under this heading. Order cases and packing-material early, as soon as reliable estimates of the crop can be made.

—W. K. Dallas, Orchard Instructor, Christchurch.

OTAGO.

Reports from various growers throughout the district indicate the prevalence of black and green aphis on stone-fruits. At this time of the year the best remedy is Blackleaf 40, thoroughly applied with plenty of force to penetrate into the curled leaves where the aphis is hidden. A strength of 1-800 is recommended. The addition of about 4 lb. soap to each 100 gallons of spray mixture increases the effectiveness. Apply a second dressing about a week later, as one spraying will not be sufficient to control this pest effectively, and a further spraying may be necessary.

Codlin-moth will be at its worst now. Keep the fruit well coated with arsenate of lead during December and January, and pick off and destroy all infected fruits. Cherry and pear slug will also need checking with arsenate of lead, and a second application may be necessary. Use hellebore powder on ripening fruit, as it does not stain the fruit; 2 lb. to 50 gallons water will be sufficient. Do not allow woolly aphis to take charge of the young shoots on apple-trees. Spray well with Blackleaf 40, at 1-800.

Fungus diseases will need further treatment, especially powdery mildew and black-spot. Lime-sulphur can still be used at 1-120. Care must be taken during hot weather; if very hot use atomic sulphur, 8 to 10 lb. to 100 gallons. Peach-rust will also need precautionary measures. Self-boiled lime-sulphur, 8-8-50, is the safest to use on stone-fruit trees.

Lighten the crop by thinning all overloaded and stunted trees, either pip or stone fruits.

In marketing fruit remember that honest grading and packing gives the best returns. Let the information given on the outside of the package be a guarantee of the contents. Put the choice fruits into trays and crates; second-grade fruit should not be packed in them. Do not allow stone-fruits to stand in the sun after removal from the trees; this is often the cause of sweated and rotten fruit arriving on the market.

—J. H. Thorp, Orchard Instructor, Dunedin.

THE APIARY.

G. V. WESTBROOKE, Apiary Instructor.

THROUGHOUT the main parts of the Dominion January is one of the busiest months for the bees as well as the beekeeper. This is the period when the clover yields the greatest quantity of nectar. It is therefore necessary for the apiarist to put in as much time as possible attending to the requirements of the hives—to see that there is an ample supply of supers and combs for the storing of nectar. Where there is a shortage of these it will be necessary to commence extracting as soon as the combs of honey are sealed over by the bees. It is not necessary to wait until every cell is capped, but it is advisable to see that at least three parts of the comb is covered. If the honey is extracted before it is capped there is a grave risk of its fermenting sooner or later. It is not advisable

to extract during wet or damp weather, as honey, like salt, will quickly absorb moisture, and it is this excess of moisture in honey which causes it to ferment. Many beekeepers prefer to leave the honey in the hives until later on in the summer. This is good policy where ample supplies of drawn combs are available.

In many parts it will still be necessary to take precautions to prevent swarming, but hives containing young queens are not so likely to swarm. When the main honey-flow is on the bees seem to give all their attention to gathering stores, and are not so keen on swarming.

THICK HONEY.

In many parts of the North Island beekeepers have great difficulty in extracting the honey from the comb owing to its density. This is particularly so with manuka (or tea-tree) honey. Where there is only a small portion of this unextractable honey, it is advisable to put it aside to be used for winter or spring stores, but where a large part of the crop consists of such it is necessary to find means of separating it from the wax in order to market it. In past years the custom has been to press out the honey in a powerful press, but in recent years it has been found that the steam-heated comb-reducers or capping-melters are much quicker and less trouble. In either case it means the destruction of the combs.

Where the steam- or water-heated honey-melter is used it is advisable before using it for the first time to see that it is free from leaks, as unless it is well soldered the shaking it receives during transit from the supplier will frequently cause the joints to loosen. The slightest leak in the machine may ruin the honey. Another matter to be attended to is making sure that the honey and wax, when melted, get away quickly, otherwise overheating will result and the honey will acquire a burnt flavour. Honey can be heated up to a temperature of 155° F. without its flavour being injured to any extent, provided it does not remain at that temperature for more than a few minutes.

QUEENS.

Many beekeepers will now be receiving the new queens ordered from breeders. Full instructions have been given in recent issues on how to introduce them, but it may be well to warn the beginner not to judge the queen by her appearance. It frequently occurs that a purebred Italian queen will look almost black. One can only judge by her progeny. In the ordinary course her first workers should be freely emerging about four weeks after her introduction. If these are uniform in colour and all have the marking of a pure Italian, then the queen is right, no matter what her own colour is.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

THE supply of vegetables next winter and early spring is largely dependent on the planting that is done during the three or four weeks beginning with the third week in December. Leeks, brussels sprouts, and early broccoli should be out by the end of the first week in January, following with midseason and late broccoli, cabbages, and savoy. These latter are often planted too early; they should not come into use until the weather is cold.

It is a good plan to lift the plants of the brassica family—cabbages, &c.—a week or two before they are to be planted out, and heel them in a plot of well-pulverized soil. A shallow trench should be opened, the plants arranged against the outer wall of the trench in a sloping position, a good watering given, and the trench then filled by digging forward so as to leave a similar trench 8 in. or 9 in. from the first. Proceed in this way till a sufficient number of plants are heeled. About 3 in. from plant to plant will be sufficient. In this position the plants will quickly make new roots, and when transferred to their growing-quarters will require very little care.

When the final transplanting is done, provide a tub with a few inches of water in the bottom, and stand the roots of the plants in the water for an hour or two before planting. When the plants are taken from the tub for planting take a handful of mud from the bottom of the tub and rub it over the bundle of

roots. This will protect them from the sun during the operation of planting. Some people wait for rainy weather for planting, but this is a great mistake. Firstly, the rain may be long coming and valuable time be lost. Secondly, if plants are put out during rain they wilt as soon as the sun comes out. Thirdly, planting in rain is a messy job that takes long in doing. The work can be more expeditiously done in dry weather. The plants get some hold of the soil, and when rain comes they are in a position to benefit by it and rush into growth at once, with no more wilting.

One hears of such methods as making a puddle of clay and cow-manure to dip the roots in. Such methods are quite unnecessary and are a waste of time. The manner of planting is of far greater importance. Most people plant with a dibber. This is a quite efficient implement when the soil is full of moisture, but with some soils (it has serious deficiencies when the soil is dry and especially if it is at all stiff) it is not by any means a good way to deal with plants that have a good stock of roots. The best implement to use is a hoe with a handle about 15 in. long and a narrowish blade about 5 in. deep. Planting requires two strokes; one brushes away the dry crumbs from the surface; the next is driven in the full depth of the blade, and a slight pull to the operator opens a space between the hoe and the soil. The roots of a plant are then inserted in this space, the hoe is withdrawn, and the soil firmed either by a prod with the head of the hoe or with the toe of the boot. This method of planting provides that no loose dry crumbs of soil come in contact with the roots, and avoids the cramped hole made by a dibber, which hole has smooth compressed walls that in some soils become very hard. Lastly, the work is done much quicker with the hoe; five thousand plants can be set out in a day of eight hours by a smart man.

For the purposes of cultivation it is necessary to have the rows quite straight. In the case of small cultivations the rows are usually set by garden-line. For large areas a marker is necessary. A marker is a home-made contrivance consisting of a length of 3 in. by 2 in. timber, with teeth made out of a 3 in. by 1 in. batten, the marking ends being sharpened. A rake-handle with stays of wire is attached to the marker, which has four teeth set at the distance desired. Some guide is necessary for the first row. This may be a line or a straight harrow mark. For the second and subsequent sets of rows the inner tooth of the marker travels down the last drill; thus a four-tooth marker really makes three drills.

Swede turnips should now be sown. Thin the plants when large enough to about 8 in. apart. A last sowing of peas may be made early in January. A medium-height variety or a dwarf should be sown. French and butter beans should be sown for succession. The last sowing may be in February in the North Island and other places not subject to autumn frosts. A sowing in January will be the last in cooler places. Turnips may be sown in small breadth, also lettuce in rows to be thinned instead of transplanting. Marrows, pumpkins, &c., will soon be in strong growth. When the strong runners have extended a yard or so they should be stopped by pinching the points off. This will encourage fruit-bearing laterals. Root crops—carrots, parsnips, &c.—should be thinned as early as possible and the soil kept loose around them.

Leeks should be ready for planting. Very few now plant in trenches—a method that is wasteful of time and space. It is not denied that larger specimens can be grown in trenches, but the greater weight from a given area is secured without trenches, and giant specimens are not really wanted. Good soil that has been deeply trenched is required. Draw a drill as though peas were to be sown, but deeper if convenient, and plant in this drill. Leeks for planting should be 8 in. or more tall. They should not be trimmed, neither roots nor top. Lift the sets with a fork so as not to injure the roots. To plant, thrust a dibber its full length into the soil, and rotate slightly to increase the diameter of the hole. Lower a plant its full length into the hole, then lift it till the crown is level with the top of the hole; this will straighten the roots. Next thrust the dibber two-thirds its length into the soil a few inches from the hole, with the point slanting towards the bottom of the hole. Then bring the handle upright against the plant with a sharp push. This will fill the hole and firm the soil about the roots. Writers in England are advising this plan, but with the difference that they do not fill the hole, leaving it to be filled gradually. This latter plan has the objection that the roots are left loose in the soil. My experience has been that when treated in that way in this country many of them bolt to seed instead of growing. Plant 8 in. apart in rows 18 in. asunder. A little bonedust should be sprinkled in the rows before planting; a portion of it will be carried down to the roots during the operation of planting.

Tomatoes should have frequent attention in the way of stopping waste growth. This should be done while the shoots are small, so that they can be pinched off. This effects a saving in labour and conserves the strength of the plant to fruit-production. Spraying should not be neglected, particularly if the weather be showery or if the plants have been given much fertilizer or manure.

Where mildew is known to occur it will be a wise precaution to spray onions at once with 2-2-40 bordeaux mixture, or with sulphide of potassium, $\frac{1}{2}$ oz. per gallon of water. The latter is the simplest spray, as it requires no preparation, while the bordeaux does, and also requires a resin sticker. The resin sticker is made by boiling together till dissolved 1 $\frac{1}{2}$ lb. resin and 1 lb. washing-soda in 2 gallons water. This is sufficient for 50 gallons of spray mixture. Spraying for onion-mildew is effectual only when used as a preventive. If the disease once obtains a hold it cannot be stopped, except by injuring the crop with the spray; in fact, when the disease gets a firm hold the remedy is more destructive than the disease.

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

WITH the hatching operations all over and the chickens at an age when they do not require almost constant attention the poultry-keeper will now be able to devote more of his time to the ordinary work of the plant. In this connection a matter for first consideration is to thoroughly clean and spray the houses with strong disinfectant as a means of keeping vermin in check. All litter, nesting-material, &c., should be removed before the spraying-work is carried out. It must be remembered that in hot weather these insect pests multiply at an alarming rate, and if constant warfare is not waged against them the stock, especially the young ones, will suffer. The wise poultry-keeper never allows vermin to make their appearance, particularly in the case of the red mite. He realizes that whether they are present in large or small numbers they mean a steady drain on his profits, for a laying-hen cannot be expected to produce a maximum egg-yield if nightly tortured by these blood-sucking parasites. He sees that preventive measures are taken even if there is no sign of vermin present.

When called upon to advise regarding loss of stock and poor egg-returns during my visits of instruction, it is surprising to find the number of poultry-keepers who will give an assurance that their plant is free from vermin, and assert that it is in no way responsible for the trouble, yet when a search is made the place is found to be overrun with them. As an instance, I was recently asked to advise at a place where chickens were dying by the hundred during the brooder stage. I found that the system of feeding and brooding was all that could be desired, and the owner declared at the outset that red mite was unknown on his plant. On making a search, however, the cause of the mortality was made plain. From top to bottom of the brooder-house the red mite was found in every crack and crevice. It was little wonder that the chickens were dying like flies, and in the circumstances it would have been surprising if they had not. Because red mite cannot be seen during the day it is never safe to conclude that it is not present. The mites hide during the day in secluded places and attack the birds by night, and owing to this habit it is to be feared that too often they are responsible for much worry and loss to the poultry-keeper while escaping his observation. The only way to make sure that a house is free from red mite is to dig into the cracks and hiding-places with a penknife. If the dust, &c., is collected on a piece of white paper the mites will be readily seen if present. Strict attention to cleanliness and frequent disinfection are the first essentials in keeping the quarters free from these enemies of the fowl.

CHICKEN-POX.

Several inquiries have reached me of late regarding outbreaks of chicken-pox. This disease is rarely seen in the South Island, but is common in the North Island, particularly in the far North. It usually begins with yellow crusted nodules of various sizes on the comb and wattles. It is highly contagious; therefore as soon as the disease makes its appearance the affected birds should be isolated, and the quarters thoroughly cleaned and disinfected. The next measure is to get the blood of the birds in good order, not only in the case of diseased birds, but all others

in the flock as well. For this purpose give frequent doses of Epsom salts and sulphur—about 1 oz. of the salts for every twelve birds, dissolved in the water with which the mash is mixed, and a similar quantity of sulphur thoroughly mixed with the dry ingredients of the mash before adding the water. In districts where fowls are subject to this disease periodical doses of salts and sulphur as directed will tend greatly towards rendering the birds immune from the trouble. The diseased parts on affected birds should be daily dressed with carbolized vaseline.

Sometimes the disease is accompanied by diphtheric roup. This takes the form of cheesy matter collecting about the mouth and windpipe, while the breath usually becomes foul. When these two diseases go together and have gained a foothold, there is no telling when the disease is going to be stamped out. In bad cases it is better to kill the fowl and burn the carcase, as one bad attack renders the victim susceptible to further attacks. In addition to the treatment already prescribed, and as a cure, the following is recommended: Take a shallow dish or similar receptacle, fill it with pure kerosene, and dip the bird's beak in this sufficiently deep to cover the nostrils. Hold the bird in this position until it breathes; this will have the effect of drawing the kerosene to the seat of the trouble. Repeat the treatment on alternate days until a cure is effected. Another remedy that may be tried is to place, say, one or two small Condy's crystals on the end of the finger, and after moistening them work them round the bird's mouth until dissolved. This will cause a discoloration of the bird's mouth and also of the finger, which will have a harmless effect on the latter and a beneficial effect on the former. After treating a diseased bird care must be taken that the hands are well disinfected before handling fowls that are free from the disease.

As is the case with most troubles affecting poultry, the only safe policy with chicken-pox is to prevent it. The first essential in this respect is to keep the quarters clean, and by good feeding and proper management maintain the flock in a healthy state, in order that the birds may have the power to resist infection should they come into contact with it.

FORTHCOMING AGRICULTURAL SHOWS.

Tuapeka Agricultural Society: Lawrence, 27th December.
 Horowhenua A. and P. Association: Levin, 12th and 13th January.
 Woodville A. and P. Association: Woodville, 25th and 26th January.
 Helensville A. and P. Association: Helensville, 29th January.
 Feilding I., A., and P. Association: Feilding, 1st and 2nd February.
 Te Puke A. and P. Association: Te Puke, 3rd February.
 Pahiatua A. and P. Association: Pahiatua, 4th February.
 Clevedon A. and P. Association: Clevedon, 5th February.
 Otago A. and P. Society: Dunedin, 9th and 10th February.
 Dannevirke A. and P. Association: Dannevirke, 9th and 10th February.
 Rodney Agricultural Society: Warkworth, 12th February.
 Masterton A. and P. Association: Solway, Masterton, 15th and 16th February.
 Northern Wairoa A. and P. Association: Aratapu, 19th February.
 Omaha and Pakiri A. and P. Association: Leigh, 23rd February.
 Franklin A. and P. Society: Pukekohe, 25th and 26th February.
 Hauraki Plains A. and P. Association: Ngatea, 26th February.
 Egmont A. and P. Association: Hawera, 2nd and 3rd March.
 Morrinsville A., P., and H. Society: Morrinsville, 9th March.
 Matamata A. and P. Association: Matamata, 15th March.
 Ashburton A. and P. Association: Ashburton, 17th March.
 Mackenzie County A. and P. Society: Fairlie, 28th March.
 Methven A. and P. Association: Methven, 31st March.
 Mayfield A. and P. Association: Mayfield, 31st March.
 Oxford A. and P. Association: Oxford, 7th April.
 Temuka and Geraldine A. and P. Association: Temuka, 7th April.

(A. and P. Association secretaries are invited to supply dates and location of their shows.)

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

DANISH AND NEW ZEALAND COCKSFOOT-SEED.

"WISTERIA," Puaha :—

Can you supply me with the following information: Is Danish cocksfoot-seed superior to Akaroa seed in germination, purity, &c.; can it be procured in New Zealand at the present time; is Denmark a great producer and exporter of cocksfoot?

The Biologist :—

The quality of Danish cocksfoot imported into New Zealand is superior to Akaroa-grown, particularly in regard to germination. Danish cocksfoot averages well over 75 per cent. germination, while Akaroa averaged last year about 55 per cent. The superior quality of the Danish may be attributed to the methods they adopt for the growing of this seed. Their system is to plant or sow in rows sufficiently wide to allow of intercultivation, and there is no doubt that this system results in a splendid-quality seed, and very big crops may be produced. Our system of simply cutting the seed when ripe, and allowing the crop to take care of itself for the rest of the year must result in deterioration of quality and crop. The use of power machines in threshing is also a factor which has influenced the germination of New-Zealand-grown seed, the power thresher being able to beat off the last of the seeds, which are usually immature. When the flail was used such seed adhered to the straw. Before the war regular shipments of Danish cocksfoot were made to New Zealand from Denmark, but export from that country fell off considerably during the war period. A good deal has been imported this year, however.

WASHING-OUT COWS.

H. C. THOMSON, Carterton :—

In the article on diseases of live-stock in the *Journal* for October occurs the statement that the only time at which the washing-out of the genital organs of cows is effective is immediately after calving. Does this mean that syringing with disinfectant at any other time is of no use? If a cow which has aborted visits the bull, say, two or three months afterwards, will she infect the bull, and will he in turn infect the rest of the herd? If so, what is the best preventive?

The Live-stock Division :—

The only time at which the womb can be effectively washed out is before it begins to contract. This process begins shortly after calving, and as soon as the animal again becomes pregnant the womb closes, after which no washing-out process can reach it unless force is used. Where disinfectant is forced into the womb of a pregnant animal abortion usually takes place. The diagram in the Department's Bulletin No. 20 ("Contagious Abortion," &c.) fully illustrates this. A heifer which has aborted and has been treated for abortion at the time should be again washed out, as far as is practicable, two or three days before being sent to the bull. There would then be small chance of his becoming affected thereby; but in any case it is a wise precaution to treat him occasionally as recommended in the bulletin. Proper sanitary attention to cows, both before and after calving, would not only assist to check abortion, but would reduce septic metritis to a minimum.

SWOLLEN UDDER IN COW.

A. DYER, Tauhoa :—

I have a cow which came in five days ago, and at that time appeared well. Since then her udder has become very much swollen and hard. The animal will not feed, and appears to be in pain. I have applied hot water very frequently, and rubbed with vaseline. Please advise me as to how the trouble should be treated.

The Live-stock Division :—

Such cases are best treated by fomenting the udder two or three times a day. After the fomentation the following liniment should be well rubbed in: Liquid extract of belladonna, compound liniment of camphor, soap liniment, mixed in equal parts. The mixture should be well shaken before it is applied. In these cases the inflammation is generally so severe that it affects the system and puts the animal off her food, and it is advisable that a purgative should be given as follows: Epsom salts, 8 oz. to 10 oz.; ginger, 1 oz.; raw linseed-oil, 1 pint—administered in 2 quarts of thin oatmeal-gruel.

PRODUCTION OF SEED OF MANGOLDS, CARROTS, ETC.

"REPRODUCTION," Spreydon :—

Will you kindly give me some information with regard to the successful growing of seeds of mangold, carrot, swede, and broccoli? I have some very fine specimens of mangolds and carrots, and wish to reproduce from them.

The Biologist :—

All the plants mentioned are more or less subject to cross-fertilization, and therefore mixed strains are likely to result if more than one variety of mangold, carrot, or swede be grown in or near the same locality. Swedes and broccoli must not be grown together for seed, as each one is likely to fertilize the other. A distance of at least half a mile should separate each variety of carrot, mangold, and each species or variety of the turnip family. Single-variety crops of carrots, mangolds, or swedes, however, may be grown for seed side by side. In the production of this type of seed selection of the best bulbs throughout the crop is necessary to ensure a good strain of bulb being maintained. In all our root crops the tendency is to revert to the original wild non-bulbing form, and hence the necessity of pulling out from a seed crop all those bulbs of an inferior type. The crop could, of course, be gone through carefully, and these inferior bulbs removed, but in the setting-up of a good strain a start should be made only with bulbs of a good shape and uniform type. These are best lifted and transplanted to a nicely sheltered spot. Birds are very destructive on small seed crops of the turnip family. The seed produced from these selected transplanted bulbs would form the seed used in the production of the next year's root crop, which would be let go for seed as it stood in the field. Prior, however, to the crop running to seed the crop should be gone through carefully and a further selection of the best bulbs made. These bulbs again are lifted and transplanted to the sheltered spot, and they will once more give the seed for sowing the next year's crop, the ordinary crop being harvested for seed that is used by the trade for ordinary feed-crop producing purposes.

FAILURE OF CONCEPTION IN COW.

"FARMER," Tokoroa :—

We have a young cow which had her first calf last year but is not coming in this season. The bull has been running with her all the winter. She does not seem to come on regularly, the period being sometimes two weeks and sometimes up to six weeks. We shall be glad of advice to enable our ensuring her coming in next season.

The Live-stock Division :—

We would advise you to keep the animal away from the bull for a period of, say, three months. About ten days before being put to the bull she should be washed out with a solution of corrosive sublimate and water, one tabloid to a quart of water. Again, when the cow comes in season it would be advisable to wash her out with a solution of bicarbonate of soda (baking-soda), one tablespoonful

of soda to a gallon of water. It should be observed that certain cows fail to get in calf despite any treatment that may be applied. Such animals had better be fattened and sold as beef.

NOTICE.—An answer cannot be given to "V. D. M.'s" inquiry regarding grass and fodder crops unless full surname is furnished.

LIST OF QUALIFIED VETERINARY SURGEONS.

THE following list of qualified veterinary surgeons known to be residing in New Zealand is published for the guidance of stockowners and for general information. In the event of the name of any properly qualified veterinarian being omitted, it is requested that he communicate with the Editor, giving particulars of his qualification, in order that the necessary steps may be taken for the inclusion of his name in the next published list.

*Ashe, G. G., M.R.C.V.S., Timaru.
 *Barnes, A. W., M.R.C.V.S., Hastings.
 *Barry, W. C., M.R.C.V.S., Christchurch.
 Bayley, A., M.R.C.V.S., Wanganui.
 Begg, W. F., M.R.C.V.S., Te Awamutu.
 *Blair, W. D., M.R.C.V.S., Invercargill.
 *Blake, T. A., M.R.C.V.S., Masterton.
 Brodie, A. M., M.R.C.V.S., Hastings.
 *Broom, G., M.R.C.V.S., Gisborne.
 *Burton, S., M.R.C.V.S., Hamilton.
 Cockroft, J. E., M.R.C.V.S., Feilding.
 *Collins, W. I., M.R.C.V.S., Wellington.
 Crossley, F., M.R.C.V.S., Palmerston North.
 *Cunningham, T., M.R.C.V.S., Oamaru.
 *Danskinn, J., M.R.C.V.S., Dunedin.
 *Edwards, W. H. H., M.R.C.V.S., Auckland.
 *Elphick, E. E., M.R.C.V.S., D.V.H., Wellington.
 Glover, F., M.R.C.V.S., Hamilton.
 *Hickman, A. J., M.R.C.V.S., Auckland.
 Hankin, F. H., M.R.C.V.S., Point Chevalier.
 *Haugh, P., M.R.C.V.S., Petone.
 *Howard, E. C., M.R.C.V.S., Wanganui.
 Johnson, A. A., F.R.C.V.S., Christchurch.
 *Kerrigan, J., M.R.C.V.S., Christchurch.
 Ky'e, H. S. S. G.M.V.C. (Meli.), Templeton.
 *Lyons, J., M.R.C.V.S., Auckland.

*Marsack, H. L., V.S. (Ontario), Auckland.
 Marshal, D., M.R.C.V.S., Balclutha.
 Martin, H. E., M.R.C.V.S., Christchurch.
 McLeod, J., M.R.C.V.S., Christchurch.
 *Meade, R. H., M.R.C.V.S., Palmerston North.
 Miller, J., M.R.C.V.S., Invercargill.
 Neale, C. R., M.R.C.V.S., Hawera.
 *Paterson, A. M., M.R.C.V.S., Timaru.
 Quinnell, W. C., M.R.C.V.S., Wellington.
 †Reakes, C. J., M.R.C.V.S., D.V.Sc., Wellington.
 *Reid, H. A., F.R.C.V.S., D.V.H., F.R.S.E., Wellington.
 Ring, W. C., V.M.D. (Penn., U.S.A.), Ellerslie.
 Siddall, E. L., M.R.C.V.S., Opatiki.
 Simpson, C. S., M.R.C.V.S., Auckland.
 *Snowball, W. D., M.R.C.V.S., Dunedin.
 *Stafford, J., M.R.C.V.S., Christchurch.
 †Stapley, W., M.D., D.V.Sc., M.R.C.V.S., Cambridge.
 Taylor, Alex., M.A., M.R.C.V.S., Lincoln.
 Taylor, J. B., M.R.C.V.S., Waverley.
 Taylor, W. G., M.R.C.V.S., Stratford.
 Ward, J., M.R.C.V.S., Katikati.
 *Wood, R. B., M.R.C.V.S., Waitara.
 *Young, A. R., M.R.C.V.S., Wellington.

* Officers of the Live-stock Division, Department of Agriculture.

† Director-General, Department of Agriculture.

‡ Not now practising as a veterinary surgeon.

EXPORTATION OF WOOL.

THE Comptroller of Customs notifies, under date 19th November, 1920, that the Minister of Customs has granted general permission for the exportation to any destination of (a) greasy or scoured wool clipped on or after the 1st July, 1920, and (b) slipped or washed skin wool. If any person wishes to export any greasy or scoured wool clipped prior to the 1st July, 1920, application should be made to the Comptroller of Customs, Wellington, stating the number of bales desired to be shipped, the marks and numbers, the date on which it was clipped, and, if possible, the name of the exporting vessel and the probable date of her departure.

Albany Fruit Show.—The annual show of the Albany Fruitgrowers' Association will be held at Albany on 19th February, 1921.

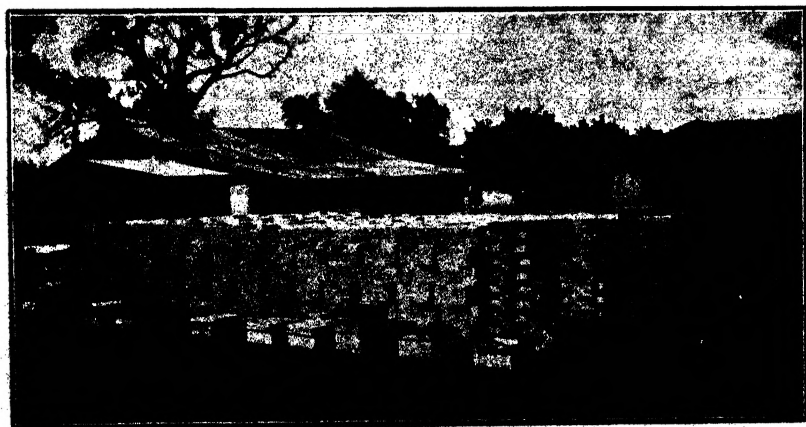
Sheep-skins and Pelts.—The prohibition of the exportation of sheep-skins and pelts has been revoked by Order in Council dated 22nd November, 1920.

THE SEASON'S LAMBING.

FOLLOWING are complete estimates of the current season's lambing, computed from estimated average percentages of lambs dropped, furnished by the Department's Inspectors of Stock in the various districts. Corresponding figures for the three previous years, together with the actual numbers of lambs tailed, are also given for comparison.

Year.	Number of Ewes put to Ram.	Estimated Average Percentage of Lambing.	Estimated Number of Lambs.	Actual Number of Lambs tailed.
NORTH ISLAND.				
1920 ..	5,838,704	87.95	5,135,524	..
1919 ..	6,311,797	81.57	5,148,779	5,120,000*
1918 ..	6,846,049	85.62	5,881,682	5,734,594
1917 ..	7,475,418	87.50	6,539,033	6,292,838
SOUTH ISLAND.				
1920 ..	5,729,845	80.20	4,595,426	..
1919 ..	5,996,709	72.23	4,331,883	4,326,385
1918 ..	6,175,981	76.50	4,728,391	4,750,777
1917 ..	5,784,751	87.25	5,072,307	4,901,329
DOMINION.				
1920 ..	11,568,549	84.11	9,730,950	..
1919 ..	12,308,506	77.02	9,480,662	9,446,385*
1918 ..	13,022,030	81.50	10,610,073	10,485,351
1917 ..	13,260,169	87.50	11,611,340	11,194,167

* Approximate.



SIXTEEN HUNDRED 12-FRAME HIVE-SUPERS MANUFACTURED BY MR. W. LENZ, MASTERTON, FOR USE IN HIS APIARIES THIS SEASON.

F. A. Jacobsen, photo.

IMPERIAL AGRICULTURAL RESEARCH
INSTITUTE LIBRARY
NEW DELHI.

[illegible]